One Horton Heath
Parcel 1.1 and 1.2

Eastleigh Borough Council

Mechanical, Electrical and Public Health specification

60663039-ACM-ZZ-ZZ-SP-BS-00001

June 2023

Building Engineering

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Eastleigh Borough Council

One Horton Heath Parcel 1.1 and 1.2
Mechanical, Electrical and Public Health Specification
60663039-ACM-ZZ-ZZ-SP-BS-00001
June 2023

Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
T01	28/10/2022	Stage 4 Tender	JE	John Edmondson	Associate Director
T02	20/06/2023	Stage 4 Tender updated to include Parcel 1.2	PB	Phil Brown	Director

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NOTES FOR TENDERERS

This document has been compiled using text from the National Engineering Specification (NES) which is copyright to Trimble. The format and content of the specification has, however being considerably re-arranged and amended from that provided by Trimble.

The technical content of this specification has been prepared using the Common Arrangement of Work Sections for Building Works and is in four sections. Where any British or other standard referred to in the specification is either out of date or superseded by another standard, the most recent version shall apply.

For reference each work section ends with clause 10000. Here is stated the latest revision of the raw NES on which the AECOM specification work section is based.

SECTION 1 – SCOPE OF WORKS
A summary description of the Works by Work Section.

SECTION 2 – WORK SECTIONS
The specification for each Work Section is generally sub-divided into two parts:

Part 1 System objectives

The system objectives are clauses giving details of the performance and/or design parameters.

Part 3 Clauses specific to the system

These clauses are specific to the Work Section concerned.
Where clauses contain "type" references, these are for cross referencing within the specification and do not necessarily relate to manufacturers types.

NB: (***Part 2*** relates to the format used in the raw NES and selection schedules for the Y clauses. ***Part 2's are not used in AECOM specifications and are replaced by schedules in section 4***)

SECTION 3 – REFERENCE (WORKMANSHIP) SPECIFICATIONS – Y clauses
These clauses specify items that are common to several systems (for example pipework, ductwork and cabling).
The individual clauses are generally arranged in the order of the Common Arrangement "Y" sections from which they originated.
Generally these specifications represent AECOM's standards, contain all contain clauses applicable to each particular category and are not project specific.
Where choices are required, they are made in the Schedules or Scope of Works; otherwise all of the clauses are applicable.

SECTION 4 – SCHEDULES
This section contains schedules of drawings, manufacturers, equipment duties and selections for plant, ancillaries and system components, specific to this project.

ENQUIRIES TO MANUFACTURERS
Enquiries to manufacturers should include all relevant sections as well as any related contractual information. ie the relevant work section and Y clauses pertinent to the plant item in addition to the plant schedule.

NON-NES CLAUSES
Clauses which are structurally different from NES from which they originated, or are AECOM originated clauses, are generally identified by the clause reference being underlined and/or the last digit of the clause number being increased e.g. 300.010 becomes 300.011.

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Scope of Works

General

Project Description

The project involves the construction of mechanical, electrical and public health systems for the apartment and houses of One Horton Heath Parcel 1.1 and 1.2

Location: Horton Heath, Eastleigh

Building Services

This specification is for the supply, installation, testing and commissioning of the following building services systems.

P30 - Trenches / Pipeways / Pits for Buried engineering Services
R10 - Rainwater Pipework / Gutters
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W51 - LV Earthing and Bonding
W52 - Lightning and Surge Protection
W53 - Electromagnetic Compatibility
W60 - Central Controls / Building Management System
W70 - Structural Cabling System

Builders Work

The demarcation of responsibilities for builders work in connection with the engineering services as defined in the Main Contract Preliminaries shall be agreed with the Main Contractor during the tender period and clearly identified in the tender submission.

BIM use on the project:
Not Applicable.

Scope of Works

Commissioning

The contractor will undertake the commissioning for all the system including off site testing and pre-fabricated elements and will work with the site wide comissioning manger.

- Heat pump manufacturer to provide commissioning procedure and if different from installer, to review commissioning records and approve as appropriate.

- Demarcation of responsibilities

- Commissioning of plant off site as part of factory testing
- N/A for multiple residential

- Commissioning allowances / margins used in the design / plant duties
- As per heat pump manufacturer requirements

- Handover requirements
- Provide complete O&M pack for energy services company to include all dwellings, pipework, manifolds etc.
- Provide dwelling specific customer manual and training.
- Seasonal commissioning

Commissioning shall be to heat pump manufacturers requirements and compliant with Microgeneration Certification Scheme requirements with certificates made available for inspection. The contractor should also allow for discretionary witnessed commissioning to be hosted as required.

Design and Project Team / Responsibilities

Client Representative - Ross Blakemore (Eastleigh Borough Council)

Client appointed Commissioning Management Specialist - TBC

Principal Designer (Under CDM Regulations 2015) - (On design and build projects the Contractor's duties shall include the Principal Designer and Principal Contractor roles as defined in The CDM Regulations 2015) - TBC

Architect – Axis Mason

Project Manager - TBC

Quantity Surveyor - TBC

Structural Engineer - Ridge and Partners LLP

Landscape Architect - Deacon Design

Building engineering, building energy profiling and specification production - AECOM

Specalist geothermal technical design – Genius Energy Labs (sub-consultant to AECOM)

CDM Regs
If not covered elsewhere in the tender documentation, give details of Pre-Construction Information and any significant risks etc

In the Construction (Design and Management) Regulations 2015 there were 9 key changes

	Potential Impact
1. Structural simplification of the Regulations	The HSE proposes to make them clearer and easier to understand. This is largely aimed at small to medium projects which tend to use SME's companies
2. The CDM Coordinator role replaced by a 'Principal Designer'	When the regulations some into force a Client will need to appoint a 'Principal Designer' for all projects involving more than one contractor (trade contractor) on site at one time. Any Designers appointed should not carry out any work

	beyond initial design unless the Principal Designer has confirmed that the Client is aware of their duties
3. Principal Designer and Principal Contractor appointed for all projects with more than one 'trade' Contractor on site.	The Client must appoint both the Principal Designer and Principal Contractor in writing, otherwise they are deemed to be carrying out these roles.
4. Duties to be applicable to domestic projects	It is proposed for projects involving more than one contractor that the Principal Contractor will normally assume the Client duties. The domestic Client can choose to appoint the Principal Designer for the project. If, however, they do not make this appointment, the first Designer appointed during the pre-construction phase is the Principal Designer for the project. If so, the Principal Designer will be answerable to the Principal Contractor in their role as 'Client' for the project and will be responsible for liaising with them.
5. Construction phase plan is required for all projects	The Client is to ensure a Construction Phase Plan provided by the Contractor or Principal Contractor is in place before any works commence.
6. Threshold for notification.	The Client will need to notify HSE of projects before works commence if they will exceed 30 construction days with 20 or more workers working simultaneously or if the project exceeds 500 person days
7. 'Explicit competence' requirements removed.	The Client will need to ensure those that are to be appointed (i.e. Designer, Contractor or Principal Contractor and Principal Designer) can demonstrate appropriate information, instruction, training and supervision.
8. The current 'Approved Code of Practice (ACoP) will be substituted with HSE and Construction Industry Training Board (CITB) Industry Guidance	
9. Information, Instruction, Training and Supervision (IITS) requirements.	Anyone working on a construction project should be able to demonstrate capability and have the necessary resources to fulfil legal duties. They must provide sufficient information in relation to the preparation, provision and, where necessary, revision of health and safety information such as Pre-Construction Information, Construction Phase Plans and Health & Safety Files.

Overview of Contractors Responsibilities			
Contractors responsibility	**Deliverables**	**Required at stage**	**Status**
Tender Stage			
Fully understand the tender documents. These consist of this specification (this may be in several volumes) and the tender drawings (see scheduleA11sch1)		Tender Stage	
Visit site to make themselves fully aware of the project and site specific issues		Tender Stage	
Request any technical clarifications. Note that any questions raised will be confirmed in writing and issued to all tenderers.	Tender clarification documents	Tender Stage	Required
Carry out initial design work to enable cost estimation for tendering purposes and satisfy themselves of accurate tender.		Tender Stage	
Submit tender. The tender should be broken down into each system as listed in this scope of works. Confirm on the tender that any technical clarifications issued have been taken into account and that the tender is fully compliant (or list any clarifications). Note that it will be assumed that the tender is fully compliant with the tender documents unless specifically stated.	Tender breakdown as schedule A11sch4	Tender Stage	Required
Pre-start on site Stage			

Visit site to carry out any surveys necessary.	Survey notes	Pre-start on site Stage	Required
Fully understand the remaining mechanical and electrical systems and any temporary works required to allow the rest of the building to continue to operate during the contract.	RFI's as required	Pre-start on site Stage	Required
Test, commission and document existing services including pipework, ductwork and electrical containment to assess current provisions within the site boundary.	Commissioning report	Pre-start on site Stage	Required
Carry out full detailed design of all systems ensuring requirements as detailed in the tender documents are met along the requirements of the individual work sections and A13Sch - Schedule of Common Design Criteria.	Design report. Design Drawings	Pre-start on site Stage	Required
Formulate and issue technical submissions for each item of equipment and each system – agree the list of submissions with the Engineer. Note that all technical submissions should list any deviations from the specification – any items not specifically mentioned will be assumed to be fully compliant with specification. Submissions will be reviewed and given a status: (Status A – no comments, Status B – proceed but taking into account comments or Status C – rejected – re-formulate and re-submit.)	Technical submissions	Pre-start on site Stage	(See Work Sections)
Formulate and issue working drawings for all systems. Note that the use of AECOM drawings on site is NOT acceptable – all drawings used for installation must be working drawings produced by the contractor. To assist in this, AutoCad format AECOM construction issue drawings can be provided but the Contractor must enhance these as required so they are suitable as installation drawings. Working drawings will be reviewed and given a status: (Status A – no comments, Status B – proceed but taking into account comments or Status C – rejected – re-formulate and re-submit.)	Working drawings	Pre-start on site Stage	(See Work Sections)
Produce builderswork drawing and schedule indicating all holes / supports requirements etc	Builderwork drawings Builderswork schedules	Pre-start on site Stage	Required
Produce a commissioning method statement	Commissioning statement	Pre-start on site Stage	Required
Produce all Health and Safety and other method statements as required by the Main Contractor, Client and Engineer.	Health and safety method statements	Pre-start on site Stage	Required
~~Agree with Client which items of plant or material or fixtures/fittings are to be retained for their stores. (If Stripout)~~	~~Schedule of retained equipment~~	~~Pre-start on site Stage~~	~~Required~~
Where temporary works are required to allow a system to be removed, document and agree these with the Client prior to carrying these out.	Temporary works Scope document	Strip-out stage	Required
Isolate and make safe the systems to be removed.		Strip-out stage	
Where Client has no use for the material or plant, remove from site and dispose.		Strip-out stage	

Installation Stage			
Install systems as listed in this scope of works and specification		Installation Stage	
Carryout snagging and rectify snags	Snagging status list	Installation Stage	Required
Offer systems for Engineer review prior to commissioning start	Completion certificate for each system	Installation Stage	Required
Commission all systems and produce report	Commissioning report	Commissionng Stage	Required
Offer results to Engineer for review and sample witnessing of the results	System acceptance sheet	Commissionng Stage	Required
Completion Stages			
Update working drawings to full record drawings taking account of any changes during the installation	Record drawings	Handover Stage	Required
Compile Operating and Maintenance manuals in the format required by the Client	O&M Manuals	Handover Stage	Required
Offer O&M manuals and Record drawings to Engineer for review and comments (status A, B or C will be given)	Electronic copy of documents for review	Handover Stage	Required
Attend site to provide familiarisation sessions with the Users for all M&E systems	Video of training sessions	Handover Stage	Required
Attend handover meetings as required – note that snag free handover is a pre-requisite for the PC certificate to be issued.		Handover Stage	
Include for carrying out the maintenance for one year	Maintenance schedule and log	1st year	Required
Attend site as required to rectify defects that are reported.	Defects completion report	1st year	Required
At the end of the 12 months defects period, attend site to rectify all remaining defects.	Defects completion report	End of 12 months	Required

P30 - Trenches / Pipeways / Pits for Buried Engineering Services

System Description:

Mains Water
A new mains water supply will be designed as part of infrastructure services for the residential blocks and individual houses.

Underground drainage
A new drainage system will be designed as part of infrastructure services for the residential blocks and individual houses. Foul and rainwater drainage interface points to be coordinated with Civil Engineers design.

Electrical Services

The electrical ducts will be designed as part of infrastructure services for the residential blocks and individual houses below ground services. The UPS plantroom secondary supply ducts below ground will connect each residential block evacuation lift supply which shall need to be coordinated with other services.

R10 - Rainwater Pipework/Gutters

System Description:
The above ground rainwater drainage system shall be designed and installed to satisfy the requirements of BS EN 12056-3:2000 and Building Regulations Part H (2002).

The anticipated rate of rainfall shall be based on the building life expectancy, category of design rate risk factor and storm return period in accordance with BS EN 12056-3:2000 and LABC guidance, whose latest recommendations are a minimum 0.064 l/s/m^2 rainfall intensity.

When internal to buildings, the gravity rainwater system works typically include:
• Supply, storage and installation of all new internal rainwater pipework and fittings
• Connection to all rainwater outlets and to the sitewide drainage system
• All associated steelwork supports
• All associated acoustic insulation if required
• All associated fire stopping if required
• Testing and commissioning of all above ground rainwater pipework systems.

Unless stated otherwise, rainwater drainage is external to houses and blocks of flats and designed by Architects.

House types
External gravity system of rainwater downpipes, eave gutters and balcony/terraces gutters to be specified by Architects. Pitched roof rainwater will be collected by eave gutters connecting to external rainwater pipes with recommended minimum of 75mm diameter. Cast iron pipework shall be used.

All rainwater outlets and rainwater pipe inlets to have a cage/guard to prevent debris from obstructing pipework.

Location of rainwater pipes to be coordinated by Architects and external below ground drainage system designed by Civil Engineers.

Apartment Blocks
External gravity system of rainwater downpipes, eave gutters, outlets, valley gutters and balcony/terraces gutters to be specified by Architects. Cast iron pipework shall be used.

Pitched roof rainwater will be collected by eave gutters connecting to external rainwater pipes with recommended minimum of 75mm diameter. Valley gutters are advised to have a minimum 2No 100mm drainage pipes with an equally sized overflow and a slope from the valley gutter centre towards the hopper in the facade.
Where valley gutter drains to an eave gutter and as it is not possible to have an overflow within the footprint of the valley gutter, recommendation is to have a chute opening from valley gutter to eave gutter to enable a larger flow rate and reduce blockages and include a slope towards the ends of the valley gutter.

All rainwater outlets and rainwater pipes to have a cage/guard to prevent debris from obstructing pipework.

Location of rainwater pipes to be coordinated with external below ground drainage system to be designed by Civil Engineers.

Block A3 has a Lower Ground floor considered viable to connect to external below ground drainage by gravity, to be confirmed with Civils team. If connection by gravity is not viable, a sump and pump system will be required.

Refer to Y10sch – Schedule of Pipelines for pipework material specifications.

R11 - Foul Drainage Above Ground

System Description:

The above ground foul drainage system shall be designed and installed to satisfy the requirements of BS EN 12056-2:2000 and Building Regulations Part H (2002).

The works will include:
• Supply, storage and installation of all new soil, waste, ventilation pipework and fittings
• Connection to all sanitary appliances as detailed within the architects Sanitaryware schedule, and to the site wide drainage system
• All associated steelwork supports
• All associated acoustic insulation if required
• All associated fire stopping
• Testing and commissioning of all above ground soil, waste and ventilation pipework systems.

All below ground underslab and underground drainage are part of the external infrastructure and will be designed by Structural/Civil Engineers.

Refer to Y10sch – Schedule of Pipelines for pipework material specifications.

House types
Each house drainage will connect at Ground floor to below ground foul drainage, either by Soil Vent Pipe (SVP) or appliances direct connection, strategy agreed with Architects subject to Civils Engineer design (not available through services design). Drainage shall be provided to serve all house upper levels with a soil vent pipe stack system to receive foul and waste water from fittings.

Ventilation pipes (VP) will be provided to foul water drainage system. When space is not sufficient for a vent pipe installation an air admittance valve (AAV) can be used to prevent the loss of water traps throughout the system, considering there is at least one VP her house type. AAVs shall be located a minimum 200mm above the spill over level or highest waste pipe inlet they serve, be accessible and in accordance with BS EN 12380:2002 and Building Control requirements.
Main vertical soil vent pipes shall rise to roof level and terminate above the roof finish with a vent cowl to discharge to atmosphere.
All sanitary fittings will be provided with a suitable depth water sealing trap to prevent the ingress of foul air and in accordance with BS EN 12056-2.

Condensate stack complete with tundish and HEPVO valve shall be located to serve MVHR requirements and prevent foul smells.

Access must be provided at all floor levels, changes of direction and above the connection point to the below ground drainage system.

Gullies were not provided to private bin or cycle stores as agreed with client and Architects.

Falls on soil waste and vent pipes shall not fall below the minimum stated in BS EN 12056-2:2000 Gravity drainage systems inside buildings.

Apartment Blocks
Drainage above ground will connect at Ground floor to external below ground foul drainage, either by Soil Vent Pipe or Stub Stack (SS).

Drainage from plantrooms was designed by gravity to external below ground system, subject to system levels confirmation by Civil Engineers. If building internal to external connection is not feasible by gravity, sump pumps shall be included in each block plantroom to discharge drainage in a viable connection point.

Block A3 Residential Sprinkler System maintenance shall discharge to dedicated drainage stacks within the water services riser cupboards and connect to the gravity above ground drainage system.

Ventilation pipes will be provided for foul water drainage to prevent the loss of water traps throughout the system. Main vertical soil vent pipes shall rise to roof level and terminate above the roof finish with a vent cowl to discharge to atmosphere. AAVs shall not be used in apartments.

All sanitary fittings will be provided with a suitable depth water sealing trap to prevent the ingress of foul air and in accordance with BS EN 12056-2.

All foul water drainage stacks shall be located in accessible positions for ease of future maintenance.
Drainage stacks will generally be routed down through the pipe work riser shafts from apartment to apartment. Access will be provided at all changes of direction, branches and connections to the suspended drainage system. On vertical drainage stacks access will be provided at every floor as a minimum.

Condensate stacks complete with tundishes and HEPVO valve shall be located to serve mechanical equipment requirements and prevent foul smells.

Plantrooms will be provided with floor gullies to facilitate draining down plants, connected into the buildings primary soil and waste system at strategic locations via running traps.

Deep pot yard type gullies will be provided to communal waste disposal facilities and plantrooms. Bikes stores include floor gullies depending on its size as indicated in Architecture. Car park drainage strategy agreed with Architects was that floor will have a slope towards the external area hence no floor gullies have been allowed.

Falls on soil waste and vent pipes shall not fall below the minimum stated in BS EN 12056-2:2000 Gravity drainage systems inside buildings.

S10 - Cold Water

System Design

All cold water services systems should be designed and installed in accordance with BS EN 806-2, BS EN 806-3 and supplementary guidance in BS 8558, CIBSE Guide G: Public Health & Plumbing Engineering, CIBSE TM13, HSE Approved Code of Practice L8 and associated guidance HSG274 Part 2 (The control of legionella bacteria in hot and cold water systems).

BS 8558 “Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages” is now the lead document in the area of domestic water supply. It should be read in conjunction with the BS EN 806 series and provides complementary guidance to BS EN 806.
BS 8558:2015 incorporates changes made in response to comments from BEAMA and has also been developed to work in conjunction with BS 8554:2015. Recommendations for flushing and disinfection have been revised to link more closely with the revised HSE ACOP L8 and HSG274 Part 2. It provides improved coverage of the control of Legionella, with references to PD 855468:2015.
BS 8558:2015 also provides improved coverage of the control of Legionella, with references to the HSE’s ACoP L8 and HSG274 Part 2.
The new edition of BS 8558 also includes as an informative annex the pipe sizing calculations that originally appeared BS 6700.

The content of BS 8558 includes:

- Guidance on BS EN 806-2
- Guidance on BS EN 806-4
- Guidance on BS EN 806-5
- Annex A (normative) Examples of pumped systems
- Annex B (informative) Guidance on the calculation of hot water storage capacity
- Annex C Pipe sizing calculations.

The 5 parts of BS EN 806 are detailed below:

- BS EN 806-1:2000 - Specifications for installations inside buildings conveying water for human consumption. General

- BS EN 806-2:2005 - Specifications for installations inside buildings conveying water for human consumption. Design
- BS EN 806-3:2006 - Specifications for installations inside buildings conveying water for human consumption. Pipe sizing. Simplified method
- BS EN 806-4:2010 - Specifications for installations inside buildings conveying water for human consumption. Installation
- BS EN 806-5:2012 -Specification for installations inside buildings conveying water for human consumption. Operation and maintenance.

House types
The mains water is individually metered in the outside meter chamber and then routed to each house type. Meter chambers shall be installed in line with Southern Water guidance.
Triplex houses will have an inline booster to pressurize the water prior to manifold distribution, to ensure all appliances and particularly ensuites in second floor have an adequate flow and pressure supply.
Isolation valves shall be fitted in all appliances and double check valves, check valves and thermostatic valves as in layouts.

Apartments
The mains water supply enters the building from the nearest road to the water storage plantroom, from where all water supply is stored, boosted, metered and distributed to the blocks of apartments. Block A3 includes a domestic and residential sprinkler system supplied from a combined booster set and riser (refer to S63).

A non revenue meter, double check valve and leak detection WAT03 meter shall be installed within the water meter room located at plantroom. The domestic boosted cold water service for the buildings shall be taken from the main potable cold-water storage tank.
The storage tank shall be an internally flanged base with externally flanged sides GRP pre-insulated sectional storage tank with a central division plate and a raised ball valve housing. A manifold links both sections of the tank(s) to supply fully automated packaged high and low pressure pump sets, located next to the tank(s). All tank divisions are to be fitted with warning and overflow pipes. A water management system will be fitted to the tanks to monitor and adjust the levels depending on water usage.
The boosted risers shall serve all apartments and landlord areas.

The domestic supply shall have a chemical water disinfection dosing system for protection against Legionella and Pseudomonas bacteria within the domestic water system. All water systems in the building will be designed and installed in compliance with the measures outlined in the Health and Safety Executive's "Legionnaires' disease - The control of legionella bacteria in water systems". Approved Code of Practice and guidance, 2000.
In Block A3 due to the volume of water stored for residential sprinklers the chemical water disinfection system should be recirculating the water stored in the tank to ensure water hygiene, other blocks may benefit of an inline dosing system.

Ensure all plant, equipment and materials specified for use within domestic water systems are WRAS or equivalent Reg4 certification approved.

Cistern
Guidance G16.8 and Recommendation R16.8 of the Water Regulations Guide, Second Edition, discusses the provision of warning and overflow pipes to cisterns.
In summary, G16.8 states that cold water storage cisterns should have a warning pipe, installed so as to discharge water as soon as the water level reaches the overflow level of the cistern. It goes on to say that if another, no less effective device, is used instead, then an overflow pipe should also be installed. Recommendation R16.8 suggests that a single warning/overflow pipe should be sufficient for a cistern of 1000 litres or less actual capacity. Cisterns with an actual capacity of over 1000 litres should have separate warning and overflow pipes fitted.
The recommendation defines 'actual capacity' as being the amount of water contained up to the point of overflow.

Irrigation system
No irrigation requirements were considered.

Living wall system
A wall mounted CAT5 unit shall be installed to supply the living wall system with a minimum of 22mm pipework at 3 bar pressure. Requirements to be confirmed with appointed Living Wall specialist.

Selection of CAT5 unit shall, as a minimum, satisfy the requirements of flow rate and pressure of Living Wall plantroom requirements.

Category 5 water system
A packaged CAT5 system was included in all blocks of flats to supply plantrooms, bin and cycle stores (depending on its size).

System chlorination shall be undertaken throughout the entire installation in accordance with the above regulations.

The trade contractor shall provide comprehensive data sheets for all water services components to validate specification compliance and for approval, this shall include a valid WRAS (or equal and approved) approval number with expiry date.

The works shall include the provision and full installation in accordance with the above legislation and guidance and include:
• Pipework
distribution system throughout the building as described above.
• Thermal insulation and vapour sealing of all cold water pipework. Flora and fauna proof where external.
• All pipework to be flushed as latest BSRIA / CIBSE Guides
• Chemical cleaning of all pipework, components and plant through the provision of a chlorine injection tee on the water supply entry.
• All water meters, sub water meters, isolation valves, drain valves, strainers, non-return valves, pressure reducing valves, double check valves, anti-vacuum/water hammer arrestors and ancillaries.
• Associated support steelwork.
• Testing, commissioning and operation demonstration.
• Electrical earth bonding to ensure electrical continuity of all systems in accordance with the IET Regulations.
• All builders' work including holes for pipework penetrations.
• All pipework fire collars/sleeves
• Flexible joints/connections where services pass over building movement joints/isolation springs. These must be accessible.
• Allow for installation of all control valves sensors, pockets, etc. in accordance with the controls trade contractor's requirements. These must be accessible.

Note: Compression fittings, including valves and any ancillary fittings shall only be used in accordance with the workmanship clauses of this specification. Push fit and crimped pipework systems are not to be used.

Refer to Y10sch – Schedule of Pipelines for pipework material specifications.

S11 - Hot Water

System Description
All hot water services systems should be designed and installed in accordance with BS EN 806-2, BS EN 806-3 and supplementary guidance in BS 8558, CIBSE Guide G: Public Health & Plumbing Engineering, CIBSE TM13, HSE Approved Code of Practice L8 and associated guidance HSG274 Part 2 (The control of legionella bacteria in hot and cold water systems).

BS 8558 "Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages" is now the lead document in the area of domestic water supply. It should be read in conjunction with the BS EN 806 series and provides complementary guidance to BS EN 806.
BS 8558:2015 incorporates changes made in response to comments from BEAMA and has also been developed to work in conjunction with BS 8554:2015. Recommendations for flushing and disinfection have been revised to link more closely with the revised HSE ACOP L8 and HSG274 Part 2. It provides improved coverage of the control of Legionella, with references to PD 855468:2015.
BS 8558:2015 also provides improved coverage of the control of Legionella, with references to the HSE's ACoP L8 and HSG274 Part 2.
The new edition of BS 8558 also includes as an informative annex the pipe sizing calculations that originally appeared BS 6700.

The content of BS 8558 includes:

- Guidance on BS EN 806-2
- Guidance on BS EN 806-4
- Guidance on BS EN 806-5
- Annex A (normative) Examples of pumped systems
- Annex B (informative) Guidance on the calculation of hot water storage capacity
- Annex C Pipe sizing calculations.

The 5 parts of BS EN 806 are detailed below:

- BS EN 806-1:2000 - Specifications for installations inside buildings conveying water for human consumption. General
- BS EN 806-2:2005 - Specifications for installations inside buildings conveying water for human consumption. Design
- BS EN 806-3:2006 - Specifications for installations inside buildings conveying water for human consumption. Pipe sizing. Simplified method
- BS EN 806-4:2010 - Specifications for installations inside buildings conveying water for human consumption. Installation
- BS EN 806-5:2012 -Specification for installations inside buildings conveying water for human consumption. Operation and maintenance.

Domestic hot water in houses and apartments is produced by a Ground Source Heat Pump system with an indoor unit, supplying hot water to a DHW cylinder. The domestic hot water system shall store water at 60ºC to deliver water to take-off points at a temperature of no less than 55ºC. All domestic hot water cylinders shall have an immersion heater able to elevate water temperature for pasteurization.

To mitigate the risk of scalding all bathtub mixers will be temperature-controlled via a TMV set to 48°C to comply with Building Regulations Part G. In the accessible apartment all appliances shall comply with Building Regulations for scalding prevention.

Temperature and expansion relief drains will discharge to a metallic pipework and via a waterless trap into the nearest services cupboard soil vent pipe.

The guidance note below to be accounted for is taken from HSC ACOP L8: *“Thermostatic mixing valves (TMV’s) should be sited as close as possible to the point of use”.*

Refer to schedule S11 Sch3 for standards, types and details of TMVs.

Refer to Y10sch – Schedule of Pipelines for pipework material specifications.

S61 - Dry Risers

System Description

All apartment blocks shall have a dry riser main installation, designed, installed and tested to the requirements of BS EN 9990:2015, in accordance with Fire Strategy.

1No100mm diameter dry fire riser shall be provided in each stair core or lobby. In addition, 1No 100mm diameter dry falling main shall be required in the Lower Ground Level of Block A3.

Each dry main is fitted with a 65mm diameter landing valve outlet housed within recessed cabinet or exposed within the protected lobby and located on every floor level (including roof level if a flat roof). With the exception of the ground floor all landing valves shall be exposed type, they shall be coordinated with the layouts such that they do not encroach into the refuge space (depth not to exceed 200mm). In all cases a landing valveshould be installed with its lowest point 750mm above floor level.

Dry mains, each incorporating a two-way breeching inlet shall form the fire brigade inlet point. Breeching inlets housed within inlet boxes at ground level (at fire service access level) shall be located on the accessible road side

in front of each block of apartments. Inlet boxes fitted with door and engraved lettering or a specific finish as requested by the Architect. The inlet boxes shall be positioned with its lower edge between 400mm and 600mm above ground level.

The dry fire mains shall be completed with intermediate isolation valves at distances not exceeding 10m, shall be chained and padlocked open, electronically monitored, interfaced with BMS system and valves shall be easily accessible for maintenance. The specialist contractor shall coordinate any access hatches/doors required with the architect.

Dry Fire mains and associated pipework and fittings shall be of suitable heavy quality galvanised steel to meet the pressure, robustness and durability requirements of the system.

Dry fire mains shall have an operating pressure of 12 bar.

The finish of the dry riser landing valve outlet boxes shall be to the approval of the architect.

Automatic air relief vents will be provided at the top of the dry riser main, and lowest point of the dry riser shall be provided with drain valves with plugged outlets.

The Specialist Contractor shall provide fire stopping for the pipework penetrating fire rated constructions.
The Fire stopping fire rating shall match the fire rating of the construction through which the pipework passes through. The whole installation will be earth bonded in accordance with the IEE Regulations and additionally will be bonded regarding lightning protection.

All final verification details of the Dry Riser systems shall be by the specialist trade contractor.

Dry Risers shall be hydraulically tested in accordance with BS 9990:2015. Visual inspection and performance tests shall be carried out. The contractor shall liaise with the Client and other services contractors prior to performing testing and provide test certificates on completion of all tests. Any faults detected during the tests shall be rectified and the tests shall be repeated until has satisfactorily completed. Commissioning tests shall be witnessed and signed by the contractor and client's representative in a timely manner prior to Practical Completion and handover.

S63 - Sprinklers

The system outlines the design for the residential sprinkler installation in Apartment Block A3, which shall form part of a full design undertaken by the appointed sprinkler contractor.

The system shall be designed and installed in accordance with:

- BS EN 9251:2021
- BS EN 9252:2011
- Building Regulations
- Building Control / District Surveyor requirements
- Loss Prevention Council Rules and amendments including the latest LPC bulletins
- Local Fire Officer requirements
- Insurance Company requirements
- Fire safety strategy report.

The Contractor shall be responsible for the development of the life safety sprinkler scheme performance design details, as shown on the Tender drawings and in the associated documentation, into comprehensive detailed scheme design information. Full hydraulic calculations should be carried out by specialist in accordance to Clause 5.10 of BS EN 9251:2021 to determine system flow and confirm water supply capacity and hydraulic gradient prior to works.

The appointed contractor shall have third party certification as Loss Prevention Certification Board LPS 1301 scheme (or equal Warrington fire Certification Ltd: FIRAS scheme). Upon completion of the installation, a "Certificate of Conformity" shall be issued, thus verifying compliance with the defined installation standards.

Scope of Works

System Description

Residential Sprinklers are designed to Block A3 in accordance with current Fire Strategy Report (20/06/2022). Prior to Tender, Fire Strategy for Block A3 shall be confirmed in case there are any changes.

A combined water storage will be located in Block A3 Ground Floor plantroom to supply Domestic and Residential sprinkler installation full capacity volume.

Residential sprinkler installation is supplied from the boosted cold water main in a riser via a flow switch assembly at each floor. Residential sprinklers fit out within apartment shall be extended from a capped supply terminated inside apartment demise. From the flow switch assembly, a signal will be relayed to fire alarm panel via BMS system that shall interface and actuate a priority demand valve.

The installation shall include for all isolation and draining of existing branch pipework, cleaning, flushing, testing, setting to work, commissioning, and identification of the systems in accordance with the British standards and LPC rules. Installation to also include all associated support steelwork, fire stopping, and builderswork information.

Should a metallic pipework system be selected, earthing and bonding shall be provided by the Sprinkler Trade Contractor to ensure electrical continuity of all the systems in accordance with the IEE regulations. Provide earth lugs to enable connection of each system to earth by the Electrical Trade contractor.

Sprinkler heads shall be quick response type, suitable for life safety residential applications. The use of rapid drop flexible pipes is strictly forbidden, and the system will be designed to meet the full requirements and standards of relevant statutory bodies.

This specification shall be read in conjunction with the following documents:
• Prelim's 'A' Clauses Specification
• Materials and Workmanship S63, S63sch schedule of Sprinklers and 'Y' Clauses Specification.

Fire Main
The incoming water main shall supply the water storage tank via a Water Utility Water check water and leak detection meter, check valve, isolating valve and drain valve. Refer to Section S10 for further details.

Combined Residential Sprinkler & Domestic Water Tank
Domestic water main shall feed the combined sprinkler and domestic water tanks in sectional GRP, refer to Sections Y21sch and S10. Water tank and pumps are located in Ground Floor plantroom.

Residential apartments and communal corridors/lobbies should be sprinkler protected to a Category 2 standard with a minimum design discharge density of 2.80mm/min, for 2 sprinkler heads, and a duration of supply for 30 minutes, as agreed with Fire Strategy. With the current Architectural design still in progress, confirm prior to works the considerations above with Fire Strategy namely sprinkler protection of sterile communal areas, space or provision for storage, materials, charging outlets, and ancillary areas.

The arrangement of the pipework to each of the tanks shall be set to balance the cistern compartments outflow and enable the effective capacity volume required for sprinkler and domestic water usage. 'Effective capacity' is the volume of water above the suction connection inlet and below the point of overflow warning. The tanks shall be in full compliance with the requirements with BS 9251:2021.

As for a shared domestic water and residential sprinkler water supply system (clause 5.11.44 within BS 9251), the appointed specialist sprinkler contractor shall (in addition to the dedicated sprinkler installation) review, validate and certify (as clause 6.2.6 within BS 9251) all shared water supply components, plant, controls and power supplies which are provided as part of the shared domestic water supply system to ensure full compliance with the requirements of BS 9251. Full hydraulic calculations should be undertaken to verify tank volumes and pump duties.

Sprinkler Pumps
The domestic and residential sprinkler are supplied by the combined sprinkler and domestic cold water boosters in the Water Plantroom which provide the water flow and pressure for BCWS, note the BCWS is provided with motorized priority valves downstream of the branches to the sprinkler risers. For a description of the combined sprinkler and domestic water booster set refer to Section S10scp and S10sch3.
The combined sprinkler and domestic cold water boosters shall be provided with a dual power supply from the conventional electrical supply and the life safety standby generator with auto changeover switching.

Apartment block
At each level within the services riser there shall be a dedicated branch off the sprinkler riser and pipe which shall be provided with a branch connection incorporating a lockable floor zone isolating valve, a flow switch and test drain being located adjacent to the cores fire fighting lobby.
All floor flow switches shall be monitored at a dedicated status indication panel located adjacent to the main fire alarm panel. The sprinkler panel shall provide visual indication to the Fire and Emergency Service of the floor on which the sprinkler system has activated. Power supplies to this indicator sprinkler panel are to be provided by the MEP Trade Contractor.

All floor flow switches in apartment block shall be monitored at a dedicated remote alarm panel located adjacent to the main fire alarm panel. This panel shall also provide pump status information and shall be interfaced with the main fire alarm panel and the BMS. (not to be interfaced with the 'Firemans' Ventilation Override Panel). All signals from the sprinkler system shall be relayed via interface units on the fire alarm system except for pump status which shall be hard wired.

Technical interfaces
Power supply to sprinkler pumps panel by Electrical sub-contractor, wiring to remote initiation pressure switches and control wiring, supply & installation of fan heaters and thermostatic controls in pump room. Supply, installation & wiring of the trace heating connected into either a controller or a thermostat.

Interfaces
Interface and monitoring requirements between the sprinkler system and the following building services systems are detailed below:

Fire detection and alarm systems

Power supplies

control systems
Functions to be monitored
Position of stop valves controlling water to system
Water storage tank level
Fuel tank level
Water pressures
Electrical power to pump sets
Temperature in sprinkler valves and pump room

Access control/security systems
Requirements for special protection, insulation, trace heating etc.
Test/drain requirements
Trace heating requirements

Control Requirements
Details of all the controls for this Work Section associated with the central control system are described in Work Section W 60 – Central Controls

Where local controls are to be provided with this Work Section:
Describe here any local controls which are to be provided
line mounted items which are not associated with the central controls, particularly direct acting valves etc.
those items provided in a panel associated with packaged plant

The Controls provided with the pumping unit are to operate to maintain the pressure in the system between the settings of the pressure controller.

Provide the following:
a. Local control and indicator panel located on the pump set with the following:
All necessary relays, fuses, safety circuits, interlocks, sequencing controls etc.
'Power available' indicator

Pump starters, MANUAL/OFF/AUTO selector switch
Lead pump selector switch
Pump 'run/trip' pilot lights
'low pressure alarm' pilot light
'low water level alarm' pilot light

b. High and low water pressure controllers
c. Duty pumps to operate on drop in pressure
d. Low water pressure alarm (local to plant)
e. Low water level alarm (local to plant)
f. Provide sensing devices, auxiliary contacts etc. to enable the following conditions to be monitored by the Central Control system.

Pump condition – run/trip and/or duty/standby
Low pressure alarm
Low level alarm

T14 – Heat Pumps

System Description:

Ground source heat pump (GSHP) system will be provided in this development and carried by ground source heat pump specialist.

The MEP contractor shall allow for GSHP installation and commissioning

The ground loop system, pipework, boreholes and other below ground components shall be designed and installed by borehole specialist and is covered in separate specification. Please refer to specification number 60663039-ACM-XX-XX-SP-ME-00001.

Each apartment / house will have a self-contained GSHP Unit that will be supplied with ground loop water from the boreholes. The GSHP units shall generate LTHW at 65 deg C for the purposes of generating Domestic Hot Water and 45 deg C LTHW for underfloor heating.

The unit will be complete with a 2-port modulating valve which will open and close under the dictates of the systems programmer/time clock. The Time switch/programmer shall be provided by unit manufacturer and residential fit out contractor shall do the wiring.

The GSHP units shall be installed complete with their own integral controls as supplied by the manufacturer, configured to prioritise the generation of domestic hot water.

Unless otherwise specified the heat pump shall be complete with microprocessor controller capable of the following:

- Complete autonomous operation, with all appropriate integral protection devices, fault indication and logging, with facility to output common fault alarm.
- Provision for remote heat pump enable and remote heating or cooling control inputs.
- Provision for controlling ground loop and primary circulating pumps
- Provision of all internal and / or external sensors, programmable weather compensated set points for heating and / or cooling.

Ground source heat pumps deliver heated water via conventional emitter systems. This would typically consist of a underfloor heating system controlled by any form of 'smart' heating control specified by the client, so the end user interface and experience can be altered to suit the various requirements of build types and market sectors.

The emergence of 'time of use' tariffs such as Octopus Agile allow the heat pump to make further running cost savings when coupled with intelligent controls. These systems learn the building physics and customer preferences and use an API to combine this with forecast weather data and the cost of electricity over the next 24 hours to develop a bespoke daily program that maintains homeowner comfort levels whilst optimising the operation of the heat pump to minimise its running cost.

Mechanical Installer shall allow for design and installation of:

- All above ground pipe work, connection onto HDPE pipe work, all plant room fit-out including installation of heat pump units, circulation pumps and buffer vessels.
- Heat pump, circulator and buffer tank (where required) installation.
- Provision and pressure testing of pipework connections to heat pump
- Provision of facilities for thermal expansion, draining, venting, flow regulation, flow and temperature measuring.
- Insulation of pipework to / from heat pump.
- Energy metering and display (if required)

Electrical Installer

- Provision and testing of electrical power / earthing and control wiring to heat pump, sensors, M&E control panels and circulators.

T20 - Primary Heat Distribution and Local Heating Units (Incorporating T30, T31 and T42)

The Contractor shall engaged to the nominated ground source heat pump specialist for the design, supply, installation, testing and commissioning for the secondary heat distribution and any heating requirement as specified for the One Horton Heath Parcel 1.1 and 1.2.

The Contractor shall design, supply and install all above ground pipe work, connection onto the underground loop pipe work via the GSHP.

The MEP contractor shall allow for GSHP installation and commissioning

An expansion specialist shall be employed by the contractor, to assess the pipework expansion and advise on flexible joints, guides, anchor points etc. The contractor shall confirm in his tender submission, that all provisions for pipework expansion have been included. The contractor shall advise of any structural implications following selection of devices.

System Description
A heat distribution system is to be provided as indicated below and on design intent drawnigs and schematics.

Space Heating Strategy
Underfloor heating shall be provided for all floors of apartments unless specified below.

Underfloor heating shall be provided for Ground floor of houses. All other floor within the houses shall be equipped with radiators.

Underfloor heating shall be provided for Ground floor of Maisonettes. Upper floor within the Maisonettes shall be equipped with radiators.

Apartment and Houses Heating Distribution
The MEP utility cupboards within each apartment are the focal point for accommodating apartment services, including: distribution boards, IT equipment, mechanical ventilation heat recovery (MVHR) units, ground source heat pump unit, underfloor heating manifold and the washer dryer. The MEP utility cupboards vary in size, layout and configuration. The Contractor shall take the lead role in producing fully co-ordinated installation drawings for each MEP utility cupboard.

From the incoming ground loop supply to each apartment, the flow and return pipework shall be extended to serve a GSHP unit located within the MEP utility cupboard.

Ground Source Heat Pump Unit
The unit is supplied by the nominated ground source heat pump specialist. The unit shall be provided with dedicated heating pump to circulate the secondary LTHW to the underfloor heating manifold and a differential pressure control valve to ensure the flow rate taken across the apartment is limited to the maximum design value.

Domestic Hot Water
Refer to section S11 for details of the hot water distribution.

Underfloor Heating (UFH)
An Underfloor Heating Specialist shall be appointed to design, supply, install, test and commission the complete installation, including the floor system, mechanical pumping system, piping distribution system, controls and necessary ancillaries.

The details of the underfloor construction, pumping system, underfloor heating piping system, controls (but not limited) shall be agreed with and approved by the Design Team and the Client. The Specialist shall ensure the underfloor heating delivery temperatures are suitable for the floor finishes. The construction make-up of the floor which is used for the underfloor heating is part of an architectural performance specification. As the underfloor heating is also a contractor-designed system, detailed design workshops shall need to be held to ensure the final agreed build up, acoustic and thermal insulation requirements are fully achieved.

All circuit loops from the manifold shall be provided with 2-port control valves and commissioning valves. 2-port control valve actuators shall be linked to the apartment controller.

Every room with underfloor heating shall have a separate loop and temperature sensor (temperature sensors shall also be linked to the apartment controller).

Please refer to the below table for the provision of towel rails under different tenure.

Tenure Types	Towel Rails provision
First Home (FH)	'Wet' towel rails in ensuite and bathroom
Affordable Rental (AR)	No towel rails
Private Rental (PRS)	'Wet' towel radiators to all sanitary rooms on all floors, cloakroom equipped with towel radiator
Private Open Market Sale (OMS)	'Wet' towel rails in ensuite and bathroom

APARTMENT / HOUSE HEATING CONTROLS
The contractors shall undertake all works within the apartments.

Each apartment will have a space thermostat supplied and installed to control each zone on the underfloor heating manifold, via a locally mounted wiring centre. Each zone will also be provided with floor sensor to limit the temperature and protect floor finishes if necessary.

The underfloor heating specialist will provide a wiring centre and all necessary zone control valves.

A heating demand signal from the wiring centre will enable the heating 2 port valve when any zone calls for heat.

Radiators on upper floors in houses shall be provided with thermostatic radiator valves (TRV) and lock shield valves (LSV) for balancing. Wet towel rails shall be provided with TRV's. There should be thermostat provided on each floor served by radiators as indicated on the drawings linked to the zone motorised valve.

A 7 day Time switch/Programmer will be supplied and installed within the Kitchen/Living room area and will provide the facility to disable the heating when not required. When this Time switch is in the unoccupied mode and the space temperature within the apartment falls below a preset level as sensed by the frost/setback thermostat the heating will be overridden and controlled via the zone space thermostat.

APARTMENT/ HOUSE HOT WATER CONTROLS

Domestic hot water within apartments shall be generated by respective ground source heat pump units, which are to be installed and completed with controls as supplied by the manufacturer.

Plantrooom heating
Water plantrooms shall equipped with electric radiator for frost protection. Local control with thermostat shall be provided for each water plantroom within the parcel 1.1 and 1.2.

Design Parameters

External Conditions
As indicated in 'Schedule of Common Design Criteria'.

Primary Circulation

Flow	Refer to 60663039-ACM-XX-XX-SP-ME-00001
Return	Refer to 60663039-ACM-XX-XX-SP-ME-00001

Secondary Circulation

Space Heating	
Flow	45 ^{o}C (Constant temperature)
Average Set Point	20 ^{o}C
Heat Pump Capacity	6kW
Hot Water	
Store Target Temperature	65 ^{o}C
Cold Water Inlet Temperature	10 ^{o}C

Control Requirements
Details of all the controls for this Work Section associated with the central control system are described in Work Section W 60 – Central Controls

Apartment and Houses space heating controls
A control specialist shall provide the heating controls for each apartment to control the ground source heat pump unit, underfloor heating and radiator controls, including the following (but not limit to)

- A main heating programmable controller locating at the Living space or Hall Way. The device shall allow the tenant's scheduling and manual override.
- Room thermostat and controller for each individual room where underfloor heating is served. This is local device to allow the tenant to adjust the temperature set-point, and mode of operation (Auto/Heating/ Off).

The details of controls need to be agreed between the client, design team, contractor, MEP sub-contractor and controls specialist.

The following aspects should be considered as part of the apartment heating control strategy:

- Simple user interface
- Large buttons / screen for people with impaired vision
- Potential integration with a touch screen control device or an App for a tablet device
- User temperature controller that allows for some override control but limited to stay within the optimal thermal comfort range to prevent occupants selecting temperatures which are too high or too low, resulting in extreme indoor temperatures.

Residents shall be able to control whether the underfloor heating is in auto or off.

T70 - Local Cooling / Heat Pump units

The Contractor shall be responsible for developing the design intent and for undertaking the full design, co-ordination, supply, installation, testing, commissioning and putting to work of the local cooling systems for UPS rooms in One Horton Heath Parcel 1.1 and 1.2.

A direct DX system with Fan Coil Unit shall be provided to each UPS room within the One Horton Heath Parcel 1.1 and 1.2.

The systems shall be installed in accordance with the system manufacturer's requirements, and be complete with all necessary refrigerant and condensate pipework and pipeline ancillaries, including but not limited to sensors and controls, thermal insulation, condensate pumps, waterless traps, plant bases, anti-vibration mountings, bracketry and supports.

External tray for the refrigerant pipes shall be be fitted with a lid to protect the pipes and insulation.

Where possible condense drainage shall be via gravity, however the Contractor shall allow for the provision of integral condensate pumps within the units.

Connections to drainage stacks shall be made via a proprietary approved air break fitting (HepVo Self Sealing Waste Valve).

Indoor units and outdoor condenser units must comply with the noise constraints set for the project. Refer to the acoustic consultant's information.

Units shall be selected to meet the required duty with fans running at Medium speed or lower.

Filters are to be washable type with a classification of G3 to BS EN779.

CONTROL REQUIREMENTS

Cooling system shall be provided with a local packaged control units. A common fault will be provided. A temperature shall be located within the comms room / UPS room. Each DX unit should be provided with individual controls.

Refer to T70 schedule.

U10 - Ventilation Supply/Extract

The Contractor shall be responsible for developing the design intent and for undertaking the final design, coordination, supply, installation, testing and commissioning for the ventilation supply and extract system for all residential units of One Horton Heath Parcel 1.1 and 1.2 using 'whole house' ventilation units incorporating heat recovery (MVHR) and other ventilation systems as specified below.

The units are generally located within the services/utility spaces in apartments and within the loft space in houses. The system has been designed to provide continuous background ventilation at the rates specified in the approved documents Part F with a boost setting for wet spaces.

The Contractor shall carry out overheating analysis for all units and develop the design intent into the design fully compliant with overheating criteria from Approved Document Part O. The design intent and sample overheating analysis are described in Aecom Overheating Report (Document number: 60663039-ACM-ZZ-ZZ-RP-ME-00005). The design intent indicates requirements to mitigate overheating issues as below:

- Offices with small windows in houses (House type: B2; C1(P); D1; H1) and offices in apartments shall be provided with 20l/s mechanical ventilation supplied to them day and night during peak summer temperatures. This shall be provided by changing the fan speed to boost speed.
- In apartments all bedrooms with bay windows (all blocks) and ground floor bedrooms with narrow windows (see Block B and A4) shall be provided with 40 l/s mechanical ventilation supplied to them day and night during peak summer temperatures. This shall be provided via additional supply fan which should provide flow rate shortage with dedicated switch adjacent to light switch. Refer to drawing no. 60663039-ACM-A1-ZZ-DR-ME-300002 for the design intent.

The Contractor shall be responsible for reviewing Stage 4 overheating strategy and providing requirements for all units. The design intent was based on the worst case units. The Contractor shall investigate possibility of removing additional ventilation requirements from some of the units.

The systems shall be installed complete with all necessary ductwork and ductwork ancillaries, including but not limited to grilles and diffusers, attenuators, volume control dampers, fire dampers, access panels, sensors and controls, thermal insulation, bracketry and supports.

The MEP utility cupboards within each apartment are the focal point for accommodating apartment services, including: distribution boards, IT equipment, mechanical ventilation heat recovery (MVHR) units, ground source heat pumps, underfloor heating manifold and the washer dryer. The MEP utility cupboards vary in size, layout and configuration. The Contractor shall take the lead role in producing fully co-ordinated installation drawings for each MEP utility cupboard.

MVHR within each house shall be located at the loft. The Contractor shall take the lead role in producing fully co-ordinated installation drawings for the services running within the loft.

The MVHR units shall be supplied complete with a matched silencer connected to supply, extract, fresh air inlet and discharge ductwork as shown on the drawings and in the schedule. All wall mounted or floor mounted MVHR units are to have anti-vibration pads to prevent transmission of vibration into the structure. All MVHR units are to be front access and will incorporate a summer bypass function to bypass the heat recovery exchanger when required. The supply air shall be distributed from the MVHR unit to occupied spaces i.e. bedrooms and living rooms via concealed flat plastic ductwork and plenum boxes connecting to ceiling diffuser. Vitiated air shall be extracted from wet spaces i.e. kitchens, bathrooms, WCs and utility cupboards, through concealed flat plastic ductwork, via extract diffusers.

Condensate pipework, from the MVHRs, shall be routed via an inline trap (HEPVO trap), into an adjacent drainage stack from all MVHR units.

The MVHR units shall incorporate a ‘boost’ facility activated by the lighting operation in wet spaces and by a local switch in kitchens. Incoming fresh air and exhaust ducting shall be routed to the apartment façade via external air bricks (with a minimum of 50% free area) as detailed by the Architect.

The plastic flat duct ductwork shall transform to galvanised ductwork for passage through the structure to comply with the latest standard as set out in Approved Document B (fire safety) volume 1: Dwellings.

Where MVHR fresh air intake & discharge ducts pass through apartment or house external wall the ductwork shall terminate with proprietary air-brick as shown on the drawing. Subject to practicality, the ventilation intakes and discharges shall have a minimum separation of 2m. All fresh air inlet and exhaust ducting shall be insulated. Apartment supply and extract ducting will not require insulation unless installed in the roof void.

Where apartment ductwork passes through fire rated walls (refer to Architect’s Fire Strategy drawings) they shall be wrapped with a propriety intumescent material to maintain fire integrity in the event of a fire. All other services penetrations shall be appropriately fire stopped.

All ductwork shall use proprietary fittings for bends and offsets etc. Pressure drops should be minimised by the use of 45° bends as opposed to 90° bends wherever possible. Final system pressure drop calculations based upon installation drawings shall be undertaken by the contractor prior to ordering the MVHR units.

Apartment ductwork, in particular fresh air intake and exhaust, is to be routed through the living spaces and should avoid running through bedrooms where possible.

All non-active sections of diffusers not used for supply or return air shall be sealed and blanked off.

The Residential ventilation rates shall be compliant with Part F of the Building Regulations.

All ductwork systems shall be of the low velocity type and shall be;

- Constructed of rigid uPVC plastic to DW 154 (except for final connection).
- Flame retardant to British and European Standards.

- Fully insulated along the entire length of all ductwork connected to the external.

Final ductwork connections to the MVHR unit and terminal grilles shall be a flexible PVC/polyester laminate material to a maximum of 300mm in length. Flexible connections shall be wrapped with insulation to prevent noise breakout. To minimise ceiling void depths, ductwork shall generally be flat duct type of either 204 x 60 or 220 x 90 dependent on system pressures, not circular ductwork. The Contractor shall allow for all necessary transition pieces

Purge ventilation to occupied spaces will be via openable windows.

Attenuation shall be provided on ductwork where necessary to meet the internal and external noise criteria on each system. Cross talk attenuators shall be provided where noise intrusion between adjacent spaces can arise and where individual room confidentiality is required.

Contractor shall provide attenuators where required according to Acoustic Report provided by Ian Sharland Ltd.

Kitchen Ventilation and extract systems/interlocks
The Contractor shall be responsible for developing the design, supply, installation, testing and commissioning within all apartments.

The Contractor shall supply and install re-circulatory cooker hoods within the kitchen area of each apartment to work independently of the main apartment ventilation system.

For further details, refer to the architectural kitchen specification and equipment schedule.

CONTROL
To be controlled via switching integral to the unit.

Residential Refuse Stores

Each residential refuse room shall be provided with a mechanical extract only systems, with make-up air provided by fully louvred external doors. The extract fans with duty / standby will operate on a 24/7 basis. Each fan should be provided with individual controls.

Water Plantrooms and UPS Room Ventilation

Each water plantroom/ UPS room shall be provided with a mechanical ventilation with heat recovery system within the One Horton Heath Parcel 1.1 and 1.2. Alternatively, the extract only air system could be provided if louvre door is provided for the make up air. The extract system shall be a duty / standby and shall operate on a 24/7 basis. Each MVHR/ extract fan unit should be provided with individual controls.

The systems shall be installed complete with all necessary ductwork and ductwork ancillaries, including but not limited to grilles and diffusers, attenuators, volume control dampers, fire dampers, access panels, sensors and controls, thermal insulation, bracketry and supports.

Living wall plantroom in Block A3 shall be provided with mechanical extract linked to water plantrooms MVHR and make-up air via external louvres.
Living wall plantroom in Block A2 shall be provided with natural ventilation with louvres at high and low level. Living wall supplier shall confirm free area requirements

Bike Stores

All bike stores shall be natrually ventilated via fully louvred doors.

U14 - Smoke and Heat Control

The Contractor shall be responsible for developing the design intent and for undertaking the final design, coordination, supply, installation, testing and commissioning for smoke extract and clearance system for all

apartment blocks, and integrating the system performance with the Fire Alarm and Building Controls System as required according to Fire Strategy provided by CHPK Fire Engineering Ltd.

The systems shall be installed complete with all necessary ductwork and ductwork ancillaries, including but not limited to fan units, grilles and diffusers, attenuators, volume control dampers, fire dampers, access panels, sensors and controls, thermal insulation, bracketry and supports.

Fire Fighting Smoke Ventilation Systems

All blocks are comprised of multiple floors with residential accommodation on all levels and served by one central staircase. An automatically opening vent, Head of Stairs (HOS) AOV of geometric area 1.0m² shall be provided on the top of the staircase or via top floor windows across all blocks and shall open in all instances of a fire being detected in that block. In Blocks A1, A2, A3, A4, B, C, D, E and F a natural smoke ventilation system shall be used.

In Blocks A1, A2, C, D and E there is a 1.5m^2 minimum free area AOV window on every floor.

In Block A3, there is a 1.5m^2 minimum free area AOV louvre on protected lobby and protected corridor on every floor connecting to a 1.5m^2 minimum free area natural smoke extract shaft that terminates via a louvre on the external façade of the roof.
Lower ground floor lobby adjacent to UPS plantroom shall be provided with 0.4m2 free area natural ventilation.

In Block A4, there is a 1.5m^2 minimum free area AOV window on each protected lobby and louvre on each protected corridor on every floor connecting to a 1.5m2 minimum free area natural smoke extract shaft that terminates via a louvre on the external façade of the roof.

In Block B, there is a 1.5m^2 minimum free area AOV window on each protected lobby and protected corridor on every floor.

In Block F, there is a 1.5m^2 minimum free area AOV window on each protected lobby and protected corridor on every floor.

The ventilation control panel located in the electrical riser, shall connect to the main fire control panel located at the entrance of each block and shall provide the following signals:

- Activation
- System Failure

Refer to W50 for further information.

Control Requirements

The dedicated system shall monitor the packaged staircase and lift lobby smoke ventilation system. The installation shall be independent to the residential core it serves. It shall monitor power live to panel, common fault and roof level AOV open. Refer to the Fire Consultants documentation for full details of the fire control strategy.

One AOV strategy has been adopted for the apartment blocks in the development.
Naturally ventilated corridors through window/door AOV.

Smoke control mode
This is activated by a dedicated fire detection system incorporating Smoke Detectors and Breakglass Switches in the ventilated spaces which should be supplied as part of the AOV system.

In naturally ventilated corridors when this mode is activated, the AOV at the top of the stairwell shall open to protect the staircase, and the AOV window/door on the affected floor shall open.

Each smoke ventilation system shall be controlled from master control panel, commissioned to provide the operational conditions required to meet the needs of the building. Each floor shall be provided with a fireman's override switch located within the stairwell. Each outstation shall be linked into the master control panel, a fireman's panel and a visual display indicating which area a fire has occurred in.

V20 – LV Distribution

System Description – General

The Contractor shall supply, install, test and commission the low voltage installations comprising of LV switchboards, automatic transfer switching equipment (ATSE's), sub-mains cables and containment and final distribution boards, evacuation lift / life safety plant to provide a complete system.

The site will be served by 2 SSEN substations located within the site demise to serve Parcel 1.1 and 1.2 individual houses and residential blocks. The individual houses will be supplied directly by SSEN up to the fused cut-out however the residential blocks will be provided with three phase and neutral service heads located in the ground floor electrical cupboard to supply both landlord and tenant board. The tenant board will serve each individual residential consumer unit and the landlord main board will serve the general lighting and power distribution board and plant services.

The secondary supply for the evacuation lifts and sprinkler pumps will be provided via external UPS plantroom.

The installation supply characteristics as agreed with the REC are as follows:

LV supply voltage and frequency	230/400 Volts +/-10%, 50Hz
Metering position	Refer to Distribution schematic
Type of Supply	TN-S
Earthing arrangements	Refer to Section W51
The REC's disconnection time & fault current	To be confirmed by SSEN
The external loop impedance Ze	To be confirmed by SSEN

Design Parameters

Refer to Specification MEP Combined Systems Preliminaries (103P3-E34-AEC-SP001) for Schedule A13sch for Schedule of Common Design Criteria.

The landlord distribution boards feeding lighting and small power circuits shall be provided with a minimum of 25% spare ways.

Protective devices shall be selected / set to maintain full selectivity between the device closest to the fault and the immediate upstream device.

The low voltage (LV) utility supplies for Buildings shall be provided by the IDNO.

The fault withstand capacities of main switchboards shall be as indicated on The Drawings or within schedule Y71sch2. Where not indicated in the schedule the fault withstand capacity of switchboards shall be 50kA for 1 second.

System Description – landlord areas

- **Protected stair and lobby**

The only electrical services permitted within the protected areas associated with Life Safety, i.e., lighting/emergency lighting and smoke detection.

The electrical services passing through but that are not directly related to the protected area shall be enclosed in a 2 hour fire rated ceiling or by 2 hours fire rated boxing.

Cables related to service within the protected area shall be run with steel conduit

- **Circulation or communal corridor**

The electrical cables going through the communal corridor shall be protected by steel cable trunking or steel conduit.

The LV distribution system commences from the IDNO service head connection points and concludes at the apartment consumer units, landlord distribution boards or item of terminated load/plant.

Scope of Works

The normal landlord electrical supplies are taken from a single metered connection off the local electrical network provider and distributed via the Sub Main distribution board (SMDB) and then via series of distribution board supplying the load. The landlord standby or secondary supplies are taken from the external UPS plantroom and then distributed via life safety essential board and local automatic transfer switches.

An external UPS room connection is provided to supply the sprinkler pumps located in the A3 plantroom block and the residential building evacuation lift through the ATS located on the top floor electrical riser.

Tenant supplies are also taken from the local network provider and distributed via the Multi Service Distribution Board (MSDB) to all tenant meters within the residential blocks.

The individual house shall be provided in general with single phase supply via a metered service cut-outs in an outdoor meter box mounted on the external wall located at the front of the property.

Contractor shall produce schedule identifying all meters installed reference and confirmation of validation test.

Where provision for future metering are indicated on the drawing, the device connections shall be fitted with low voltage fuses and the device cover shall be punched (suitable to accept a meter) with a blanking plate fitted.

The sub-main panel separate dedicated controls shall be provided with marshalling terminals for connection for BMS monitoring points (device status, surge protection devices etc). Terminals shall be disconnected type to permit the isolation of the BMS input/output from the switchboard auxiliaries.

The sub-mainboard shall be labelled and identified in accordance with Section Y82, in addition all meters shall be provided with a label with its unique reference and end energy use (Ventilation, cooling, heating, lighting, small power etc). **Life safety cubicles are to be coloured red.**

All fuse holders shall be colour coded with white for neutral links

The contractor shall engage the submain board manufacturer to design, supply, install, commission, test and demonstrate the equipment required for the project. Ensure the board are designed to facilitate future supplies with 25% spare ways provided without the need for panel / switchgear modification. Also ensure spare control and cable sections are incorporated as required.

Provide electrical supplies of 400V (3 phase), 230V (single phase) and neutral 50Hz within statutory tolerances. The electrical supplies to meet the systems electricity maximum demand load requirements, plus 10% spare capacity for future use.

The Contractor shall select circuit protective devices to ensure that total discrimination is achieved in the distribution system using devices supplied by the chosen manufacturer and demonstrate this prior to procurement and installation commencement.

Provide the submain board with the components, meters, interlocks, trip mechanisms, number and ratings of outgoing circuits all as indicated elsewhere within this specification. As far as is practicable locate spare outgoing circuits towards the top of the switchboard.

Provide an automatic metering system as part of the sub-main distribution board design and arrange for this system to monitor all landlords metering provisions as required for Building Regulations Part L requirements.

Carry out a complete discrimination study down to final circuit MCB level to ensure all protection devices are appropriately set. This is to consider the selected circuit breaker manufacturers specific components. Allow to set devices to reflect the findings of this report and to provide dedicated IDMT protection relays to better afford discrimination and Zone Selective Interlocking as required to achieve full discrimination down to final circuit level.

The Contractor shall employ a Specialist to carry-out a protection co-ordination study of the high and low voltage distribution systems in accordance with Clause V20.300.081, based upon prospective fault levels advised by the Engineers, and product details provided by the LV Switchboard manufacturer.

The Contractor shall install containment in accordance with IDNO requirements.

The Contractor will produce full working drawings of the system requirements and shall liaise fully with other designer(s) and team members in order to produce a fully co-ordinated working / installation system(s) drawings, enabling the services to be installed in conjunction with the required works. Allow for all on and off site based works, including meetings, project programming, resources and documentation to facilitate.

Protection Systems

Circuit breaker selection has been based on Schneider Electric electronic trip units which shall include metering facilities (or equal and approved manufacturers equivalent). All metering shall be provided with a plug in communication module, to permit each instrument to be interfaced with the EMS system.

All MCCB's, MCB's and RCBO's & AFDD's shall be from the same manufacturer.

Automatic Transfer Switching Equipment (ATSE)

Automatic Transfer Switching Equipment (ATSE's) shall be provided local to equipment requiring primary and secondary supplies for resilience to ensure continued operation in the event of one LV switchboard being out of service or interruption of the primary electricity supply.
ATSE shall be in accordance with Section Y71.2112 and Schedule Y71sch8. Two types of ATSE are to be used throughout the scheme, type as indicated on The Drawings:

Electromechanical ATSE for life safety plant, including dual bypass - Serving the life safety plant Type 1,

ATSE's shall comprise motorised 4-pole, break before make, mechanically and electrically interlocked, changeover switches arranged to automatically switch between the normal and secondary supplies. ATSE's shall include a bypass to both the normal and secondary supplies in compliance with BS 8519.

ATSE's shall be provided with volt-free contacts to provide remote status monitoring on the Firefighting Status Indication panel in the Fire Control Centre.
Type 2, electromechanical ATSE for life safety plant, no bypass – Serving life safety plant where duty and standby plant are served by independent ATSE.

ATSE's shall comprise motorised 4-pole, break before make, mechanically and electrically interlocked, changeover switches arranged to automatically switch between the normal and secondary supplies, with no bypass.

ATSE's shall be provided with volt-free contacts to provide remote status monitoring on the Firefighting Status Indication panel in the Fire Control Centre.
Interlocked Circuit breakers for non-life safety applications – Serving equipment or plant where dual supplies are required for operational resilience

ATSE's shall comprise motorised plug-in MCCB's in accordance with Work Section Y71.2112

All transfers, primary to secondary supply or secondary to primary supply will be open transition.

The plant replacement height in a section of corridor across the development will be 2.1m The Contractor shall ensure ATSE selected can be transported onto site within these restrictions.

Control Requirements

Automatic Transfer Switches (ATSE)

In the event of a power failure on the primary supplies the ATSE shall automatically transfer from the failed supply to the secondary. If the primary supply is restored, then the ATSE shall automatically reconnect to the primary supply. See schedule Y71sch for details of the automatic transfer switches.

The ATSEs shall be biased to take the preferred supply from its Primary supply source / switchboard.

ATSE shall be linked to BMS to provide notification when in Bypass, fault or operation. Please refer to BMS Points

Schedule 103P3-E34-AEC-SH502

Containment

Only primary containment has been shown on the drawings and the Contractors shall allow for secondary containment required to complete the electrical installation.

All small power and lighting cabling within landlord areas shall be installed within trunking.

Where containment crosses movement/expansion joints in the structure it shall be 'broken' each side of the joint, busbar trunkings shall be provided with expansion units.

cabling passes shall be fire and acoustic sealed as required. Fire sealing shall be in accordance with the Fire Strategy.

SubMain Cabling

Incoming and outgoing cabling associated with these distribution boards shall be LSOH multicore armoured cables to BS 6724 for all **non-life safety supplies**. For supplies to life safety plant and equipment cables shall be fire rated of 120 minutes and comprise multicore armoured cable to BS 7846.

Life safety supplies shall be duel fed from either the Primary LV board and the Life safety LV board via an Automatic Load Transfer switch local to the item served. Consequently, the incoming LV supply to each of these distribution boards shall be fire rated of 120 minutes and comprise multicore armoured cable to BS 7846 **and complying with BS 8519.**

Cable containment shall be provided in the form cable trays. Containment to be sized to allow for cable installation grouping as follows:

- Cable tray- LV submains to be installed touching.
- Residential Risers

LV Sub main distribution boards

Cable trays shall be utilised for outgoing cables from the LV SMDB to the various landlords distribution boards, plant and equipment.

Cables forming the primary and secondary supplies to the life safety equipment ATS's shall be fed via underground ducts and routed separately.

All outgoing supplies from the Primary and Life Safety board shall be check metered. Meters shall be located on the protective device cubicle door and shall be provided with an output to the Energy Monitoring System.

The central core of the building shall incorporate a landlords LV riser which shall contain a rising containment system serving a landlords final circuit distribution board. This distribution board shall be used to serve the lighting and small power requirements within the core area and residential corridor. Each distribution board shall be a split load type with separate lighting and small power sections.

Residential Supplies – Apartment Blocks

The Electrical Trade Contractor shall provide and install containment services for the LV distribution to the apartments.

Each Apartment shall be fed from the utility IDNO service fuseboard located within the ground floor electrical cupboard in the communal corridor area.

The point of interface between this work package and other work packages are as follows:

		Action / Responsibility		
Item	Description of Works	Electrical Trade Contractor	**IDNO Works Contractor**	Others
1	Installation of utility fuse boards within electrical riser.		✓	
2	Cabling from utility fuseboard to meter position riser by IDNO. Electrical Contractor to provide from Meter position double pole isolator to apartment consumer unit		✓	
3	Containment for utility (IDNO) cabling	✓		
4	Installation of meter board & double pole isolator		✓	
5	Installation of service cut out within meter cupboard		✓	
6	Meter within meter cupboard			Meter Operator
7	Responsibility of coordination of the services within the apartment utility cupboards	✓		

8	Liaising with IDNO and **Meter Operator**	✓		
9	Provision and installation of apartment consumer units & distribution boards with incoming /outgoing devices (e.g. incoming switch disconnector MCB's, RCD's, AFDD's	✓		
10	Installation of all outgoing circuits from the consumer units /distribution boards to all apartment outlets, luminaires, appliances etc	✓		
11	Label consumer unit / distribution board outgoing ways and provide consumer unit /dist board schedules indicating device and cable ratings/sizes (for each apartment).	✓		
12	Provision and installation of apartment main earth bars and terminate earth / Bonding cables	✓		

Apartment– Consumer Units

Single phase consumer units shall be provided within each of the apartments located within the designated utility cupboard. The consumer units shall be double row incorporating the following:

- Double pole isolator
- 30mA RCD isolators (Two sections as identified within the consumer unit schedules)
- Outgoing miniature circuit breakers, RCBOs, AFDD's
- Earth bar and any extensions required for bonding of services within apartments.

Consumer units shall be mounted so the top row of devices will be between 1350-1450mm from the finished floor level within the apartment for DDA access and compliance with Approved document Part P and approved document Part M.

Apartment meter board shall be 30-minute fire rated ply board 340mmm x 500mm. Incoming cable to consumer unit to be installed on metal tray within the corridor only.

All cabling between the fuse block and the meter and the meter to the consumer unit shall be double insulated.

CT Chambers and Metering:

Direct whole current meters shall be provided for supplies rated at up to 100A TPN and CT meter chambers shall be provided for supplies greater than 100A TPN. Direct whole current meters are not suitable for termination of armoured cables, The Electrical Trade Contractor shall allow to change-over to LS0H/LS0H single core cables using suitable sealable Henley type blocks.

The Electrical Trade Contractor shall provide meter boards and slot trunkings for meter tails. Meter tails shall be LS0H/LS0H cables or sleeved to provide additional mechanical protection at final connections to direct whole current meters.

Each CT chamber, switch disconnector and meter position shall be labelled and identified in accordance with Section Y82, label descriptors shall include the postal address and unambiguously identify which remote distribution equipment or individual Premises the device controls.

CT chambers shall comprise of a suitable insulated enclosure for the metering current transformers (i.e. a CT Chamber) with removable links and voltage reference fuses and test block. The enclosure shall be of a type approved by IDNO, COP5 Meter arrangement (typically, a Ryefield, Lucy all insulated, PLCT Type) and the enclosure shall be suitable to accept Specified Seals in accordance with MOCOPA® requirements.

The Contractor shall be responsible for completion of Meter Operator and Electricity Supplier Agreements for each of the permanent supplies.

Integrated Systems Test

An integrated system test (IST) shall be carried out to demonstrate the correct operation of the building services under all mains failure scenarios

- Loss of supply to landlord switchboard

- Loss of supply to individual primary equipment which includes but not limited to:

- **Evacuation** Lift
- BCWS services panel
- Residential lobby smoke extract system

- Loss of supply to secondary life safety board

- All activations tested linked to the fire alarm system

Following the completion of each failure scenario and only once all MEPH services have been restored, the lost service shall be re-instated.

Tests shall monitor, but not limited, to the following system to ensure correct or suitable behaviour

- Lighting including for emergency lighting
- Mechanical services plant and associated controls
- Lift
- Fire detection and voice alarm systems
- UPS systems
- CCTV and Security
- ATSE
- BMS interfaces
- Connections to life safety equipment

Contractor is to allow for connection and load tests for the operation of the temporary generator connection to align with the ESM requirements and provide evidence of test results and functionality result witnessed by the MEP consultant

The Contractor shall ensure attendance at the IST by all relevant parties and provide all consumables required for the tests.

V21 – General Lighting

System Description

These works shall include for the supply, delivery, off loading, installation, testing and commissioning of the complete lighting installation, including all luminaires, lamps, controls and ancillary equipment required to provide a fully operational system. The installation shall encompass all internal and external areas. The installation for the development shall meet the design criteria and reflect the architectural and aesthetic requirements of each area and location respectively.

The lighting installation shall be split into:

- General Landlord Areas including for BOH and plant spaces
- External light
- Apartments, Houses

This specification details the lighting within the general Landlord areas and the apartments as designed by AECOM.

The installation design shall be in accordance with:
SLL Code for Lighting (2020);
SLL Lighting Handbook (2018);
SLL Lighting Guide 7 Lighting for Offices (2015)
SLL Lighting Guide 9 Lighting for Communal Residential Buildings (2013)
SLL Lighting Guide 10 Daylighting (2014)
SLL Lighting Guide 11 Surface Reflectance and Colour (2011)
SLL Lighting Guide 12 Emergency Lighting (2015)
SLL Lighting Guide 14 Control of Electric Lighting (2016)
SLL Lighting Guide 16 Lighting for Stairs (2017)
CIBSE Commissioning Code L (2018)

PART L2A 2013 Assessment 103P3-E34-AEC-RP810

BS EN 12464 (Parts 1&2) Part 1:2011

For locations of luminaires, controls and final circuit wiring and protective devices serving general Landlord areas and the apartments and houses refer to the layout drawings and appendices within this specification.

Apartment and houses – Containment and distribution

All cabling from the consumer unit to the final light fitting and electrical accessories shall be flat twin and earth LSZH.

Cabling shall be fixed to the soffit, with fire rated cable cleats.

Cabling within utility cupboard shall either be concealed within wall or installed in PVC-U trunking surface mounted.

All cabling shall be concealed within apartments.

General Landlord Areas

These shall principally comprise 'Back of House' type areas at ground level and comprise:
Plantrooms
Circulation routes
Risers
Stairwells

Luminaires within these areas shall comprise both surface mounted and recessed types to suit the architectural layout and finishes. For luminaires and lamps refer to Y73sch1 for luminaire schedule.

In all areas luminaires shall comprise high efficiency LED luminaires and the installation designed in accordance with the SLL code for light. LED drivers surface mounted luminaire shall be integral to the luminaire.

All lighting lux levels testing for landlord areas shall be carried out at night time to minimise intrusion from daylight altering the lux levels. The contractor shall make allowance for 2-3 days to carry out the tests and lux levels recorded for each area. The Contractor shall provide parasitic power losses for lighting controls for each zone.

Final lighting circuits to internal luminaires shall generally be carried-out using single core LS0H cables within conduit. Wiring to external luminaires shall be carried-out using XLPE/LS0H/SWA/LS0H cables. Where XLPE/LS0H/SWA/LS0H cables are run in multiples within the landlord area they shall be run on cable trays in accordance with Y63.2021 and identified in accordance with Clause Y82.2191.
All penetrations in slabs and compartment walls through which cabling passes shall be fire and acoustic sealed as required. Fire sealing shall be in accordance with the Fire Strategy and acoustic performance requirement.

Apartments & houses

All the residential apartment kitchen and bathroom /WC cubical shall be provided with recessed downlights. The bedrooms, living room and corridor shall be provided by pendant lighting. The utility cupboards and store room shall be provided by IP rated bulkhead type fitting

In all areas luminaires shall comprise high efficiency LED luminaires and the installation designed in accordance with the SLL code for light. LED drivers for recessed luminaire shall be separate and located within the ceiling void local to the luminaire to which they are connected. LED drivers shall be selected such that they can be installed and removed via the cut out in the ceiling for the downlight.
In all cases LED drivers shall be selected to be compatible with the luminaires to which they are connected. Contractor to confirm inrush currents from LED drivers will not trip the circuit breaker, the contractor shall validate inrush currents for all drivers as part of technical submittal. The upper floor of the houses the downlight LED driver shall be covered by suitable fire rated canopies/hoods in accordance with the driver rating and performance due to the area with limited airflow.

External Lighting
For details of external luminaires refer to the Aecom lighting design information. The Electrical Contractor is responsible for the supply, installation test and commissioning of the lighting design identified on their drawings.

The lighting will be connected to the building lighting control system as identified on AECOM drawings/schematic, for apartment blocks only.

Lighting Power Density and Control Calculations.
The Contractor shall complete Schedule A13sch2 (Refer to preliminaries document) as part of the record documentation together with providing the associated evidence.

All luminaires and lighting components (ballasts, transformers, drivers and lamps etc.) shall be compatible and suitably controllable from the lighting control system provided as part of these works.
Accessories and containment shall generally be surface mounted in plantrooms, risers and voids and concealed within wall/ceiling finishes within areas with suspended ceilings.
For details of the final circuit wiring refer to Final Distribution Board Schedules.
The lighting installation shall satisfy the following:

- The Contractor shall be responsible for the installation of any independent supports required for luminaires e.g. where the ceiling system cannot support it's weight.

- Trunking shall be extended to all areas (plantrooms, corridors, above capping slabs to support any trunking mounted luminaire. Plantrooms may require luminaires to be adjusted on site due to final selection of plant and equipment. Upon completion of the project, The Contractor shall ensure that all diffusers and lamps are clean and free from dirt. All specular louvers and reflectors must be free from fingerprints.

Lighting control / Description of operation

General Landlord Areas:

Circulation and staircases:
Lighting shall be controlled via presence detection. When presence is detected, the lighting shall be activated to 100%. When presence is not detected for a period of 15 minute across the corridor on a single level the lighting shall be switched off until presence is detected.

When presence is detected via PIR within the stair lobby, the staircase lighting will be illuminated to 100%.

Interfaces

An interface shall be provided to accept a signal from the fire alarm system (volt free contract). To enable all landlord areas to be illuminated to 100% on notification of a fire.

Time clock

An astronomical time clock shall be provided and interlinked with lighting control system to provide control of building and facade lighting.

Plantrooms and Risers

Luminaires within plantrooms and risers shall be directly switched by local wall mounted manual switches.

Apartments & houses

Within these areas luminaires shall be controlled by local wall mounted switches. For lounges and bedrooms luminaire shall be wall mounted switch within the room. Bathrooms and utility cupboards shall all be provided with wall mounted manual switching located outside the room.

Testing and commissioning

The lighting control specialist employed by the Contractor shall commission the lighting control. Each apartment shall be individually tested, commissioned.

Final Circuit Wiring

Final lighting circuits shall emanate from local distribution boards and consumer units as follows:

General Landlord Areas

The installation shall generally be wired utilising single-core LS0H insulated cables run within galvanised steel trunking and conduit. Final circuits shall be protected by mcb's/RCBOs as per requirements within BS7671 and fed from the local landlords lighting and small power distribution boards.
Wiring shall be installed surface to the plantrooms, risers and circulation routes at each floor.

Apartments & houses

Within these areas the wiring installation shall comprise LSOH twin & earth cables concealed the building fabric and ceiling voids. Final circuits shall be protected by mcb's/RCBOs as per requirements within BS7671 and fed from the apartments or houses consumer unit. For final circuit wiring details refer to the distribution board schedules within this specification.

External Areas

The installation shall generally be wired utilising single core LS0H insulated cables run in conduit within the building fabric and ceiling voids.. All external mounted services final circuits shall be protected by mcb's/RCBOs as per requirements within BS7671 and fed from the local distribution boards.

For final circuit wiring details refer to the distribution board schedules within this specification. In general the external lighting will be controlled by photocell for both the blocks and houses. Houses will have in addition an override switch located inside the house to switch off the light.

V22 – General Power

System Description

These works shall include for the supply, delivery, off-loading, co-ordination, labelling, installation, testing and commissioning of the small power installations indicated on The Drawings. All components necessary for a safe, fully functioning, easily maintainable installation shall be included whether or not specifically indicated. These installations shall include, but not be limited to, all wiring, secondary containment, wiring accessories, switched disconnectors and support systems.

The main LV distribution systems are described in Scope Section V20 of this specification.

For distribution board schedules refer **to Electrical Services Distribution board schedule 60663039-ACM-ZZ-ZZ-SH-EL-402006**

From landlord distribution boards located within the electrical riser within the stairway core, small power supplies will be provided to serve socket outlets throughout lobbies, stairways, reception and plantrooms. In addition fused unswitched and switched connection units shall be provided to serve fixed appliances e.g, FA, access control switches.

For locations of small power outlets and final circuit wiring and protective devices refer to the layout drawings and appendices within this specification.
The small power installation shall comprise general purpose socket outlets and fused connection units (switched and unswitched) and isolators for fixed equipment.

Unswitched fused connection units shall be used for supplies to security equipment, door hold back magnets and Motorised Fire & Smoke Dampers/Smoke Control Dampers.

Refer to Scope W10 for containment to the Telecommunications Installation, W20 for containment to the Security Installations, Scope W61 for containment for the BMS/EMS installations and Scope W70 for containment to the IT/Structured Cabling Installation.

Where local isolators or supply connection points are remote from the nearest wall, the Contractor shall provide suitable channel supports, spanning between the soffit and floor slab. A section of cable tray shall be mounted to the channel for fixing the supply cable. Where isolators are provided, these shall be also fixed to the channel supports.

The points of interface between this work package and other works are as follows, The Contractor shall allow to co-ordinate with other Contractors to ensure compatibility of provisions:

Final Circuit Wiring

Small power circuits shall **emanate** from local distribution boards and consumer units as follows:

General Landlord Areas
The installation shall generally be wired utilising single core LSF insulated cables run within trunking and conduit. Final circuits shall be fed from the local landlords lighting and small power distribution boards. Fixed equipment final circuits shall be protected by mcb's and circuits supplying socket outlets final circuits shal be protected by RCBO's and AFDD's

Wiring shall be installed surface to the plantrooms, risers and circulation routes at all levels.

The small power within the stairs shall be a surface installation across all levels. For final circuit wiring details refer to the distribution board schedules within this specification.

Apartments & houses

Within these areas the wiring installation shall comprise LSOH twin & earth cables concealed the building fabric and ceiling voids. Final circuits shall be fed from apartments or houses consumer unit. Fixed equipment final circuits shall be protected by mcb's and circuits supplying socket outlets final circuits shall be protected by RCBO's and AFDD's. For final circuit wiring details refer to the distribution board schedules **within** this specification. Cabling shall be installed within plastic conduit within walls and PVC-U trunking within utility cupboards. In ceiling voids cabling shall be clipped to soffit.

All consumer units shall be metal and comply with clause Y71.221. The consumer unit shall be din-rail and split type to enable split load RCD sections **and RCBOS/AFDDS.** Consumer units shall be provided with an incoming double pole isolating switch. Earth bars shall be extended for necessary earth connections.

Isolators for switches within apartments refer to clause Y74.2071.

Arc fault detection devices shall be installed within apartment & houses consumer units for final circuits serving socket outlets. Socket outlet final circuits shall also be protected by RCBO's. the consumer unit design is to accommodate 2 module arrangement, the Contractor shall provide a cost comparison for a single module combined AFFD and Overcurrent protection device on the consumer unit schedules provided. This will be a separate line item for review by CWCL. AFFD devices shall comply with Y74.2235A, Y742235B.

External Areas

The external power installation shall generally be wired utilising **LSOH tsingle core** insulated cables run within **conduit**. Final circuits shall be fed from the local landlords lighting and small power distribution boards. Fixed equipment final circuits shall be protected by mcb's and circuits supplying socket outlets final circuits shal be protected by RCBO's and AFDD's. **Final circuits shall be fed from the local landlords lighting and small power distribution boards.**

Schedule of Fixed or Free Issued Equipment

Note – Contractor

Equipment	Supplied By	Fixed By	Final Connection By	Contractor's Attendance / Method of Connection

Security Door Controller	Security TC	Security TC	Contractor	Provide local unswitched fused connection units with flex outlets.
Lift	Lift Contractor	Lift Contractor	Contractor	Provide local switched disconnector as shown on drawings
Fire Alarm and EVC main	Contractor	Contractor	Contractor	Provide local switched disconnector to be finished red, padlocked in the ON position and labelled 'Fire Alarms – Do Not Isolate'
Apartment Appliances - Oven, Combi Oven	Others	Others	Contractor	A combined 6 way grid switch shall be provided to switch low level appliances within kitchen. Appliances shall be provided with a flexible outlet below the worktop (located to allow appliance to be located fully within the recess)
Apartment Appliances - Hob	Others	Others	Elec TC	A 45A DP cooker isolator switch with neon indicator shall be provided for the Hob. A 45A connection box shall be located below worktop.

General

All penetrations in the slab and compartment walls through which cabling passes shall be fire and acoustic sealed as required. Fire sealing shall be in accordance with the Fire Strategy.

All wiring accessories shall be identified in accordance with Clause Y82.2121,13A socket outlets provided for connection of fixed equipment which are not protected by RCD's shall additionally be labelled.

All plant isolators shall be identified in accordance with Y82.2080.

Final circuit MCB's supplying security systems shall be provided with a locking device and padlock to enable circuits to
be secured against un-authorized isolation.

Primary containment has been indicated on the Drawings. Provision shall be included for additional containment as required to provide a complete installation.

Power supply for IT & security rack provision shall be provided within the comms riser

V32 - Uninterruptible Power Supply

System Description

The uninterruptible power supply (UPS) shall be used as secondary supply to serve the evacuation lift and sprinkler pumps. Currently two UPS plantrooms are provided within the site to serve block A3 sprinkler pumps supply and evacuation lifts for blocks A.1, A.3, A.4. The block D UPS plantroom will provide evacuation lift's supply for block C, D, E and F.

Ensure that the UPS system is complete in all respects to perform the intended specified role considering the characteristics of the mains supply, the load to be supported, the interface and interaction with secondary power supply, the environmental conditions of the UPS room and the specified acoustic requirements.

Particular attention to be given to the load characteristics (i.e. automatic switching of loads, unbalanced loads, switched mode power supplied etc) and the interaction of UPS and secondary power supply in order to achieve stable operation at all times of both UPS and secondary power supply. Add that UPS needs comply with BS EN 50171:2021 Central Safety Power Supply Systems

6kVA to 100kVA
The UPS shall be a self-contained multiple cabinet system suitable for floor mounting.

Where required the unit shall work in conjunction with an externally cabled bypass. To enable this arrangement to operate both input and output must at all times be synchronised to allow the external bypass to be closed or opened in parallel.

Common requirements

Ambient room conditions should be taken as 30ºC unless stated otherwise.

Connectors shall be provided for incoming/outgoing neutrals. An earthling terminal shall be also be provided.

When the mains supply is restored after a supply failure the UPS system shall initially draw no power except for transformer inrush current. Over a period of 1 minute power requirement shall rise to a level dictated by the power required to drive the load.

Testing shall be carried out on site in-situ and to cover the following aspects as a minimum:

1. Cable connections and external bypass
2. Autonomy (Contractor to provide load bank)
3. Alarms
4. General operation including simulated power failure

An oscilloscope (with printer) shall be connected to the output to enable output waveform to be recorded at critical moments (via printer). This applies to systems above 6kVA only.

V34 - Electric Vehicle Charging Equipment Installations

System Description

Electrical vehicle charging points shall be provided for individual house charger 32A fed by a single-phase supply from within the house. For the location and quantity of the EV charging points refer to the architect sitewide drawing. The system shall provide active car charging points.
The car charging points shall be single or dual sockets and mounted on a house, each EVC's metering is via the house consumer unit supply.

V40 – Emergency Lighting

System Description

Emergency escape safety lighting to landlords areas shall be provided by self contained emergency lighting units. These shall generally take the form of integral or remote battery / conversion units fitted to normal luminaires to provide 3 hour duration maintained operation or stand-alone LED emergency luminaires.
For details of luminaires refer to Y73sch1 schedule of luminaire need to state design standards.

The installation shall be installed to provide illumination for escape purposes and also to enable tasks in high risk areas to be safely curtailed.

Illumination levels provided shall be:

Escape Route Lighting
- 1.0 lx minimum on the centre of escape routes
- 1.0 lx minimum within open areas (anti-panic emergency lighting)

High Risk Areas
- 15.0 lx minimum or 10% of normal service illumination level with a uniformity 'Uo' of minimum 0.1

Emergency luminaires shall be fed **from** the local lighting final circuit such that they continue to operate during a final circuit failure. For final circuit wiring details refer to the distribution board schedules within this specification.

The location of emergency luminaires shall be as **detailed** on the AECOM lighting layouts for all areas.

Emergency luminaire shall be provided to landlord area. Apartments & houses shall not be provided with emergency lighting.

The emergency lighting installation shall be tested and commissioned in accordance with Work Section Y81.

The Contractor shall allow for measuring illumination levels of the installation prior to Practical Completion. Measurements shall be carried-out in accordance with Appendix A of BS EN 1838. The Contractor shall provide a marked-up set of Record Drawings as a record of the measurements obtained.

Design Parameters
Refer to A13sch in for Schedule of Common Design Criteria.

Dedicated illuminated exit signs shall be provided to meet the requirements of the Building Control Officer and means of escape requirements.

Emergency luminaires shall highlight safety equipment and signs, in addition to providing illumination to assist safe travel along the escape route in accordance with BS EN 1838 which requires that the luminaires sited at points of emphasis must comply with BS EN 60598-2-22

W10 – Telecommunication

System Description

The placing orders for communications lines and the installation of telecommunications cables shall be the responsibility of the Contractor. The Contractors' works shall comprise of the installation of primary containment and secondary containment for direct telecommunications lines.

The points of interface between this work package and other works are as follows, The Contractor shall allow to co-ordinate with other Contractors to ensure compatibility of provisions:

The Contractor shall provide primary containment as indicated on the drawings linking;
- Building Entry Points to incoming comms cupboards

The Contractor shall provide secondary containment for the following direct telecommunications lines:
- Lift lines to each lift, **which will provide the link to estate control in case of emergency.**
- 1No at each landlord meter location for each utility meter.

Secondary containment shall comprise of steel conduits in accordance with Work Section Y61 and Schedule Y61sch interconnected to the primary containment except where multi-compartment trunkings are being provided in particular areas.

At outlet positions, The Contractor shall provide a one gang 35mm deep steel box (flush or surface to suit the area installed).

The maximum number of outlets linked by a single conduit or trunking shall be as follows:

20mm conduit	2 No. outlets
25mm conduit	3 No. outlets
50 x 50mm trunking	20 No. outlets.

All conduits shall be left with a 2.5mm^2 draw wire to facilitate the future installation of wiring.

W20 – Entertainment Systems

INTEGRATED RECEPTION SYSTEM (IRS)

System Description

To design, supply, install, commission and hand-over a fully functional Integrated Reception System (IRS) The proposed development will consist of residential block apartments and individual houses.

To provide all necessary equipment, cabling and services to receive, process and distribute sound signals, television signals, and their associated data signals for the following services:-

- FM radio
- Digital Audio Broadcasting
- Digital Terrestrial Television and Radio
- Digital Satellite Television and Radio

Prior to commencing the design, procurement and installation, it is essential the Contractor undertakes site surveys and investigations to ensure no system adversely affects the existing signals from buildings surround the site.

The installation for the residential units shall comprise terrestrial television, FM and DAB aerials, 1 No. satellite dish, active head-end equipment, coax to fibre converters, passive optical splitters, fibre to coax converters, distribution multiswitches, cabling, outlets and all the necessary ancillary equipment forming part of the final system(s).

The individual house shall be provided with FM and DAB aerials located within the loft space. Satellite dish shall not be provided for the individual house which instead shall be replaced with the sky glass new streaming product which replace the old sky Q and box and the need of the satellite dish.

All cabling shall be Fibre Optic / Coaxial cables (Digitally quality cable to specification BS EN 50117-- CT100 or equivalent).

Apartments

Aerials, satellite dish and IRS head end equipment shall be located at Roof Level with signal splitters located within the central core communications riser that runs between roof and ground floor ,

All the above areas shall be provided with IRS radio and television services via outlets as located on the drawings.

All cabling and system installation(s) shall be installed on galvanised steel cable basket (where run within ceiling voids) within the communal areas and electrical services risers.

Allow for TV booster / TV relay system as necessary. Provide booster or mast aerial if necessary to ensure satisfactory reception.

The IRS specialist shall satisfy themselves that the services stated are available on each of the sites indicated, and that the quality of the signals shall enable him to meet the relevant specification requirements

indicated. If any of the services are not available the IRS specialist shall notify the Contract Administrator in writing.

If the IRS specialist believes that the suggested systems do not meet the performance criteria this shall be highlighted at the time of tender, together with alternative proposals.

Within the areas served the satellite boxes do not form any part of the system, as each user would be required to sign up to a contract with a service provider of their choice.
All goods and materials used in providing the system shall conform to national standards and to the Codes of Practice issued by the relevant industry bodies.

Take responsibility for ensuring that the selected manufacturer's systems / equipment is fully compatible with the building elements to which the system is to be interfaced. The IRS system(s) shall be complete with all equipment, software, fixings/supports, accessories, interfaces and all systems and services required to provide a functional system.

Ensure that the systems do not undermine the weatherproofing and waterproofing systems of roofs nor any other part of a building's fabric.

The IRS specialist is responsible for the successful installation, operation and completion of the IRS system. The installation is to be fully co-ordinated and compatible with the project requirements as detailed within all contract documents.

The installation will be undertaken in full liaison with the project team, Client, Local Authorities, Utilities, other designers / installers and specialists.

Throughout the project liaise and arrange meetings / workshops with the specialists and project team to discuss installation issues and specifically routes, fixing detailed to structure, access and exposed services. The IRS specialist shall allow all necessary costs, resources and programme implications to discharge all project obligations.

Take responsibility for arranging for the connection of these systems, including agreeing the final route of the external & internal service cable(s) with the project team and reconfirming the builders work requirements.

Segregate power and data / comms wiring by spacing the systems apart, maintaining a 300mm minimum separation at all times, where they run in parallel (where possible) containing power within screened cables or containment and cross LV with data / control cabling at 90 degrees. Where this is not possible, install EMI screens / shields to containment systems.

The IRS specialist will produce full working drawings of the system requirements and shall liaise fully with other designer(s) and team members in order to produce a fully co-ordinated working / installation system(s) drawings, enabling the services to be installed in conjunction with the required works and phasing. Allow for all on and off site based works, including meetings, project programming, resources and documentation to facilitate.

Fully demonstrate the MEP systems and train the Client's authorised staff in the operation of the system(s).

DESIGN PARAMETERS

This shall include, but not limited to;

- All relevant parts of BSEN 50083: Cabled Distribution Systems for Television and Sound Signals
- All relevant parts of BSEN 50117 for coaxial cables
- All relevant parts of BSEN 60966: Radio Frequency and Co-axial Cable Assemblies
- BS 7671: Requirements for Electrical Installations (latest edition)
- The EMC Directive
- The Confederation of Aerial Industries Codes of Practice for Television Aerials and TV Systems
- B.S.7718: Codes of practice for the installation of fibre optic cabling.
- BS EN 50346: Testing of installed cable.
- BS EN 60793: Optical fibres

- BS EN 60794: Optical fibre cables
- BS EN 60794-1.2 Part 1-2: Generic specification – Basic optical cable test procedures

The TV installation is to be to BS EN 50083, which includes for earthing protection to the equipment. Installation should be carried out by a member of the Confederation of Aerial Industries (CAI).

The IRS Specialist shall supply a final commissioning certificate, indicating signals at the inputs and output of the main equipment and levels received at the outlets.

All signal levels shall comply with the maximum provided for by the amplifiers to be installed taking into account adequate de-rating for the number of channels distributed and amplifiers in cascade.

The IRS Specialist will have to demonstrate to the Contractor Administrator that the picture quality on all the services stated is to CCIR grade 4 on the analogue television channels and error free on the Digital channels.

Test equipment shall be accurate to within +/- 3dB and suitable for all the services indicated. The minimum requirement is a Spectrum Analyser, a simple signal strength indicator is not sufficient.

The tests will include the maximum and minimum signals for each of the services. The IRS Specialist shall provide a printed record of all measurements, either in tabulated or spectrum form.

The IRS must provide the following services:-

Platform	Service	Frequency
FM Radio	All national and local services legally transmitted to the general area of the site concerned.	Band II
DAB	All services from the following ensembles: 11B, 11D, 12A, 12B and 12C.	Band III
Digital Terrestrial Television	All services from the following multiplexes: PSB1, PSB2, PSB3, COM4, COM5 and COM6.	Bands IV and V
Digital Satellite Television	Services from: 1. Astra/Eutelsat 28east; 2. Eutelsat Hotbird 13east	L-band

- **Signal Levels**

Maximum/minimum signal levels at each outlet position on the IRS shall be as defined in Schedule W20.

Suitable RF distribution and amplification must be provided to distribute the radio and television services to all outlets.

Minimum requirements for signal quality shall be as defined in Schedule W20.

The IRS specialist shall supply and install in the communications riser, 9-wire DiSEqC 2.0 distribution multiswitches to serve the apartments in as shown on the design intent IRS schematic.

The IRS specialist shall provide details of the power requirements required to support the distribution equipment and any other equipment required for the IRS system.

The IRS specialist shall provide any filters, earthing kits etc. required for the IRS. Earthing will be provided adjacent to the head-end equipment by **the electrical sub-contractor**, for use by the IRS Contractor. The IRS specialist shall provide all necessary earth connections from the equipment to the earthing provided by the Contractor.

Cables and Fixings

Ensure all coaxial cables are manufactured to the relevant parts of BS EN 50117. Coaxial cables must have a nominal characteristic impedance of 75 ohms.

All coaxial cables used for the IRS must be high quality, well-screened, low loss types. All cables must have LSOH (Low Smoke Zero Halogen) jackets.

The IRS specialist shall ensure that the system is designed and constructed to provide a high degree of impedance matching, screening efficiency and to minimise the generation of signal reflection within the system.

Cables must be earthed as necessary and at no point on the system must the loop impedance be greater than 5 ohms.

Within the head-end and distribution network, coaxial cable connections must use F- type and IEC connectors. F-type connectors must be crimped. All connectors must be the correct size for the cable used.

A fibre optic cabling infrastructure shall be used to supply the required radio and television services. The fibre cabling infrastructure will comprise OS1 fibre cabling terminated in FC/PC connectors in patch panels, the Installer must provide OS1 fibre patch cords/flyleads to connect the passive optical splitters and fibre to coax converters to the fibre patch panels provided.
Ensure all fibre cables are manufactured to the relevant parts of BS EN 60793 and BS EN 60794.

Ensure that all cable bending radii is no smaller than the manufacturer's recommendations.

All distribution medium to be of high quality well screened type uniform impedance of robust construction suitable for the high end residential development.

Ensure all software licence fees are included within the tender return related to the Client's use of any software supplied by the specialist(s).

Position the equipment as required within / external to the building to suit the system design and co-ordination.

LV Power Supplies
All to be provided by the electrical Sub-contractor to suit the IRS system requirements.

Power supplies shall be via dedicated IRS LV final circuits from local LV distribution boards. IRS specialist to co-ordinate the exact positioning of all LV power supplies to all items of IRS equipment with the Contractor.

Circuits will be 20A radial circuits.

TESTING AND COMMISSIONING

General
Comply with Section Y81 and refer to common testing section for further details.
During commissioning ensure that all items have been correctly labelled and all schedules are correct and in place.

The IRS specialist shall test the system using a spectrum analyser. Tests carried out solely using a signal strength indicator will not be acceptable.

The system shall be commissioned upon completion – and certificates provided showing input and output of

all amplifier and switches and all outlet locations.

Before the hand-over of each system and before completion of the contract, the whole system shall be tested by the IRS specialist to ensure that the system complies fully with the specification.

IRS specialist shall submit with their tender:

- schedule of proposed manufacturers for all items of equipment

During the contract period the IRS specialist shall submit the following documents for the Contract Administrator's comment:

- selected manufacturer's design proposals
- manufacturer's technical submissions and proposals for the supply and installation of all items of equipment and associated components
- Design input data and calculation output sheets
- manufacturer's design and installation drawings
- installation and commissioning programme
- installation method statements
- inspection details and certificates
- operating and maintenance manuals for all items of installed components and equipment
- record drawings
- completion certificate(s)
- test and commissioning certificates

W40 – Access Control

System Description

The client will employ a specialist security system consultant to specify the necessary equipment and cabling. To facilitate the security system installation, it shall be necessary to provide at ground floor level dedicated containment extended via the riser to serve each of the apartments.

W50 - Fire Detection and Alarm

System Description

Provide a fully monitored system in accordance with the relevant parts of BS 5839-1, BS 5839-6 and BS EN 54. Include all end of line and other necessary circuit elements to facilitate monitoring.

A fire alarm specialist shall be engaged to develop the design, supply, install and commission and set to work the fire alarm system for the landlord.

Apartment Blocks Fire Alarm System

The Landlord fire detection and alarm systems shall be supplied and installed complete by the Fire Alarm Trade Contractor. The Contractor shall be responsible for the provision of power supplies to equipment (refer to Scope V22) and primary containment associated with these systems.

The points of interface between this work package and other works are as follows, The Contractor shall allow to co-ordinate with other Contractors to ensure compatibility:

Primary containment for Fire Alarms shall comprise of **medium duty cable trays** in accordance with Y63.2021 and Y61.2191 and Y63sch. These shall be identified by permanent labels fixed to the underside of the basket at corners, tees and 6m intervals along straight runs 'FIRE ALARM CABLES'.

Scope of Works

Provide a fully monitored **managed** protocol addressable fire detection and alarm system in accordance with the relevant parts of BS 5839 and BS EN 54. Include all end of line and other necessary circuit elements to facilitate monitoring. The fire alarm system shall cover both landlord areas and the residential apartments. Within maisonette with floor above 4.5m the system shall be to BS5839 Part 6:2019 LD1 Grade D

Within landlord areas the fire alarm system shall be to BS5839 Part 1: 2017 Category L5.

The system shall be provided with a main alarm indication and control panel located adjacent the fire brigade entrance.

The fire alarm installation shall comprise automatic optical smoke detectors, fixed type heat detectors, manual call points, addressable interface units. Alarm annunciation shall be by sounders combined with flashing beacons to in apartment blocks. Sounders and beacons shall also be provided to the external roof. The addressable interface units shall be provided for fire alarm system inputs such as sprinkler flow valves and to control plant and equipment during a fire condition. For details refer to the fire alarm interface schedule within this specification.

The fire detection and alarm system shall be wired using soft skin “enhanced” fire performance cables to BS EN 50200 PH120 / BS 8434-12 120min installed on dedicated cable trays in all areas.
Fire detection and alarm system internal battery fed power supplies shall provide 24 hour standby in the normal state followed by 30 minutes in full alarm / operational mode. The battery charger for the standby supply should be compatible with the batteries used, and should be capable of re-charging a battery from its final voltage to a capacity within a charging period of 24 h.

Apartments & houses

The Contractor shall provide a domestic fire alarm system within each apartment dwelling. The system shall be to BS5839: Part 6 Category LD2, Grade D system for all blocks and houses except block A3 apartments which will be provided with category LD1, Grade D system. Fire alarm devices shall be mains powered with an integral standby battery supply.

The fire alarm system within an individual apartment shall operate as one zone, in the event of an apartment system being activated all apartment sounders will operate together.

The fire alarm system is not interlinked with the Landlord fire alarm system within the common spaces. Installation within apartment or house shall be provided and installed by the Fire Alarm Contractor.

Detectors shall be provided within the following spaces:

Location	Detector Type
Living space	Optical smoke detector
Kitchen	Heat Detector
Circulation	Optical smoke detector

Sounders bases shall be provided to ensure noise levels are achieved at bedhead in accordance with BS 5839-6

The detectors shall be manufactured by AICO and comply with BS EN 14604 and BS EN 5446
The detectors shall:
- Be circular white detector enclosures, the heat and smoke detectors shall be of the same finish
- Have a base with integral terminal block and cable cover separate to the detector
- The mains cable shall not be visible when detector is removed
- Integral electronic sounder (where identified) giving a minimum output of 85 dB/(A) at 3 meres
- Integral manual test/hush button
- A green indicator to show mains power present
- A red indicator to show an alarm condition on the alarm that has triggered
- Heat detectors to be fixed temperature thermistor type sensor, triggering temperature 58°c ± 40°c.
- Anti tamper locking device to prevent unauthorized removal of the detector without the use of a tool.

Each detector shall incorporate a tamper resistant rechargeable lithium cell backup power supply to ensure protection is available in the event of mains failure. The cells shall have a minimum of a 10 year life. An audio signal shall be provided if the battery is depleted.

A remote test/hush button shall also be located within the apartment MEP cupboard.

The installation shall be a Grade D fire alarm system and provided with a mains supply to the smoke and heat detectors/ alarms. The electrical supply shall consist of a single dedicated independent circuit from the apartment's consumer unit.

The detectors within each apartment shall be interlinked together providing a common electrical supply and controls.

The fire alarms shall be wired in BS 6242B compliant cables (Twin and Earth type cables with LS0H sheath) installed concealed above the false ceilings.

The cable interconnecting the detectors shall contain 3 cores + Earth. The additional core shall provide a signal between devices to ensure that if one detector is operated all the fire alarm sounders throughout the apartment are activated. The signal core of the cable shall be provided with a red sleeve so as to be readily distinguishable from the cores supplying power to the detector.

All cables shall be **BASEC** approved.

The consumer unit shall be of a split type and the fire alarms fed from the non RCD protected side of the unit. 'Fire Alarm Supply – Do Not Switch Off' shall be written above fire alarm MCB.

For materials and workmanship refer to E3E4 specification section W50.

Apartments & Houses - Testing and Commissioning

All the detectors within each apartment shall be tested in accordance with BS 5839:Part 6 and the manufacturers' recommendations.

Dust covers shall be fitted to all the detectors to protect them from contamination during the installation phase of the apartments. The Contractor shall allow for removing the dust covers prior to handover.

A fire alarm test certificate shall be completed and issued for each apartment as part of the O&Ms.

Provided record drawing and operation instructions as per clause W50320.041

The operation of the fire alarm systems shall be as follows:

Landlord Areas

The fire strategy for these areas is a single stage evacuation based on a single stage alarm. Activation of an automatic detector, manual call point or sprinkler system flow switch shall generate an evacuation alarm. Alarm indication shall be provided to building fire alarm system.
At the same time the fire alarm system shall signal the addressable interfaces to:

- Shut down plant
- Ground Lifts
- Release access controlled doors
- **Disabled refuge/fire telephone system to be active 24/7.**
- **Disabled refuge/fire telephone system to remain active.**
- Release any hold open devices

Final system operation to be agreed with Building Control and Fire Officer.

Disabled Refuge Intercom/ Fire Telephone System Apartment Blocks.

The Contractor shall provide a disabled refuge system as identified on the schematic and the general arrangement drawings. The system is to comprise the following:

- A head-end master handset (Type A handset) and Master Control Panel shall be located within the

buildings management office and fire brigade entrance.
- Secondary handset (Type A handset) to be located within the buildings management office and boosted called water plantroom, but only connected to the infrastructure disabled refuge system.
- Disabled refuge call station shall be located at each building level (except Ground Floor) for Stairs.

Handset mounting heights are to be in line with both BS 5839 Part 9:2021 and BS 8300 requirements, whilst the master and secondary handset is to be mounted at 1,500mm AFFL. All equipment is to be flush or surface mounted to suit it's specific location. Ensure the units are selected and coordinated with the fire alarm sounder installation, to ensure the local fire detection and alarm system and any background echo will not compromise operation of the systems during fire alarm activations.

The system shall be compliant with BS9999 and BS5839 Part 9:2021 and will be battery backed for **24 hours as FAS** in quiescent mode then 3 hours in full power. The system shall be fully monitored and faults reported back to the master control panel. The system is to be provided with BMS fault monitoring. The system shall be able to control up to128 remote units. The system shall be able to control fire telephone remotes from the master control panel.

Provide Type B outstations designed for use by multi-disability users, having high contrast signage in line with RNIB guidelines and an induction loop coil (to BSEN60118-4) in the handset. Include a general-purpose relay output that closes on activation of the unit.

Type B intercom outstations to provide hands-free duplex speech and allows anyone in a refuge area to communicate with the fire access point at the touch of a button. Include an induction loop system for the hard of hearing and a general-purpose relay output that closes on activation of the unit.

The Master Control Panel will be wall mountable and housed within a unit with a lockable clear glazed door to allow easy access to the control unit and easy viewing of the display. The control panel shall have a handset, speech steered communication (DRS remotes) and full duplex speech (fire telephones). The front panel shall have a separate status display which indicates Mains Supply Healthy, Battery High & Low, Charger Fault, Fuse Fault, Common Fault, Processor Fault, Processor Restart, Handset Fault and have a lamp test button. Each Remote Call select switch on the control panel shall have Occupied and Call indication, which are clearly visible. The system shall give an indication of an incoming call by means of an LED indicator and a tone.

The Contractor shall provide a facility to listen in to refuge areas – this link must remain open until the remote unit is reset on a button press. It shall also be possible to reset from the Master Control Panel. The front panel of the remote unit will have LEDs showing System Healthy and Occupied.

The Contractor shall provide 'Slave' Control Panels to enable the system to be operated from multiple locations. Slave Control Panels shall have the facility to be configured to communicate with any Remote Units/outstations on the system.

The Contractor shall provide the system installation with a totally independent, separated and segregated enhanced wiring system in accordance with BS 9999, BS 5839-1, BS 8519 and BS 7671.

Ensure that the system uses the same cable type throughout, sourced from a single manufacturer, and that the cable manufacturer is to be BASEC approved. Ensure that the cable type is LPCB approved**. The cable will be Prysmian FP Plus PH120.**

Apartments

The fire strategy for the apartments is 'Defend in Place' consequently activation of a smoke alarm shall initiate an audible alarm indication within the apartment only. Smoke alarm shall be interlinked such that activation of one smoke alarm causes all smoke **alarms** within the apartment to go into alarm operation.

W51 – LV Earthing and Bonding

System Description

The earthing system shall be TN-S.

The Contractor shall bond to and connect to earth all exposed conductive parts of the electrical installation and all extraneous conductive parts so that in the event of a fault of negligible impedance, disconnection will take place in a manner and in such time as to ensure no danger arises.

The TN-S Earthing shall be derived from the LV service from the IDNO where a CPC will be provided for termination into the main earth terminal within Landlord cupboard. Also as there will be LV supplies there is a requirement to bond between the two bars to avoid circulating neutral currents.

The Contractor shall provide the earthing system as detailed on the drawings, and in accordance with BS7671 and BS 7430, Electricity Supply Regulations and local Regional Electricity Company requirements as appropriate

Provide supplementary equipotential bonding as defined in W51 of this specification workmanship section.

Provide the earthing system as shown on the drawings.
Bond all services entering the building as close to the entry point as possible Telecommunication service bonding to be agreed with service provider.

Suitable identification labels shall be affixed adjacent to each bar in accordance with Clause W51.320.080. The Earth bar labels shall also include a bar unique reference.

The Contractor shall liaise with the IDNO to ensure that the earth requirements for their containment systems, fuseboards have been accommodated.

Under this scope of works provide the earthing system as shown on the drawings, comprising earth bars within each electrical and all plantrooms, lift motor room and Comms cupboard.

Main protective bonding conductors shall also be installed to all incoming services pipework, electrical services containment, distribution pipework and ductwork. Bonding shall also be provided to all lift installations, outgoing sewer connections, building structure and lightning protection system. All earthing and bonding conductors shall be copper 1Core Cu/LSF type cables.

Bond all services entering the building as close to the entry point as possible. Telecommunication service bonding to be agreed with service provider.
Also provide supplementary equipotential bonding to:

- main water pipes
- main gas pipes
- air duct lines
- heating pipework
- exposed metallic parts of building structure
- thermal insulation metallic cladding
- metallic cable sheaths of all cables
- roof mounted services
- containment systems
- riser floors / partitions

Bond all simultaneously accessible conductive parts to the protective conductor system using supplementary equipotential bonds.

Agree on site with the engineer the final positions for equipotential bonding of piped services prior to procurement and commencement of the installation.

Provide an independent 6.0mm² supplementary bonding cables from locations where water services are in

general use, such as toilets etc., to the local distribution board. Ensure all bathroom and shower rooms are provided with supplementary earth bonding in accordance with BS 7671 for all Class 1 and 2 equipment circuits and provide supplementary earth bonds to all metallic pipework within these rooms. Take all supplementary cross-bonding within such locations (where water services are in general use) from the independent main bonding point to pipes and fittings etc.

Bond together metallic water pipes, main metallic gas pipes, other metallic service pipes and metallic ventilation ducting, oil pipe services, piped gas systems, etc., entering/leaving plant rooms, boiler houses, calorifier rooms, bathrooms, kitchens and other wet-process areas, and bond to the electrical installation protective conductor system.

Ensure that all exposed or extraneous conductive parts having a resistance to earth of less than 1MΩ are bonded to the electrical services earth.

Prove each circuit protective conductor prior to making any supplementary bonding connection.

Bond final connections of all extraneous metalwork by means of a bolted type lug connection in a suitable position to be agreed with the engineer. Use only bronze nuts and washers when fixing earth tape.

Connect all the protective conductors for bonding to the earthing system at the nearest convenient earthing terminal provided in an outlet box or equal. Conductors are to be installed within ducts etc, and where necessary within conduits to outlet boxes.

For the Comms room provide a functional earth in accordance with BS 6701 and BS EN 50310.
All cables shall be cream and labelled with telecommunication functional earth.

Houses
Each apartment shall be provided with a TN-S connection originating from the IDNO LV Network.

Design Parameters

Refer to Schedule A13sch Schedule of Common Design Parameters within prelims document

BS 7671 IET Wiring Regulations

An acceptable test to establish whether an item is an extraneous-conductive part is as follows:

Using a 500V dc insulation tester, measure the insulation resistance between the possible extraneous conductive parts and the main earth terminals;

- If the resistance **1**Mohms or greater, then the item can be reasonably be expected not to be an extraneous- conductive-part.
- If the resistance is 0.05ohms or less then the item is already bonded and no further connections are required.
- Where the resistance is between 0.05ohms and 0.25Mohms, equipotential bonding shall be provided, in accordance with the recommendations of BS 7671.

Steel conduits and trunkings shall not be relied upon as cpc's and separate cpc's shall be provided with each circuit.
Bond and connect to earth all exposed conductive parts of the electrical installation and all extraneous conductive parts so that in the event of a fault of negligible impedance, disconnection will take place in a manner and in such time as to ensure no danger arises.

Provide the earthing system as shown on the drawings.

Provide supplementary equipotential bonding as defined in W51txt to the following buildings / zones / locations:
UPS plantroom.

W52 – Lightning and Surge Protection Systems

System Description

Apartment Blocks

The lightning protection system to the building is provided by the Façade Contractor in accordance with BS EN 62305 and as defined in AECOM specification.

Under this scope of works the contractor shall provide bonds to the lightning protection system as per Section W51 of this specification.

Additionally, the Contractor shall provide and install transient overvoltage protection (Surge protection) devices in accordance with BS 7671 and BS EN 62305-4.

Where surge protection devices are fitted their protective device shall be the first device connected to the busbar after the incoming device. Refer to schedule W52sch1 for details of surge protection devices.

Surge protection devices shall be provided in the following location

- Type 1 at each Sub main distribution board
- Type 1 on each distribution board servicing external circuits.
- Type 2+3 on all sensitive equipment distribution boards that serve cabinets.

Design parameters

BS 7671 Section 534, 443 and BS EN 62305-4

Surge protection devices shall be provided in the houses.

W53 – Electromagnetic Compatibility (EMC)

System Description

Provide, design, install, commission and demonstrate the complete electrical installation within the shell and core areas to comply with the Electromagnetic Compatibility Regulations, together with associated acts and statutory instruments. To ensure that the electromagnetic disturbance generated by the selected systems and equipment are not to exceed a level allowing other systems and equipment to operate as intended.

To select, locate and arrange control and signal systems and equipment so that they are segregated from, and sufficiently clear of, power equipment for no adverse influences to arise.

Provide suitable metallic screening to protect susceptible parts of the facility, systems and equipment from influences which could cause disruption to operations.

The Contractor shall be responsible to ensure that all the selected cable / sub-main & system(s) distribution routes are such that the level of electromagnetic radiations including those from the high and low voltage cables do not create disturbances that affect the operations of other systems, unwanted or excessive human and Health & Safety effects and equipment. All systems and equipment selected shall have adequate levels of immunity to electromagnetic disturbance to enable them to operate as intended.

The Contractor shall make due allowance for the future installations within, risers and all services distribution

routes, to enable other package Contractors to install their works. Zones shall be clearly identified on the Contactors working & installation drawings. These are to be agreed in writing prior to procurement and installation commencement and EMC analysis and reviews are to make due allowance.

The Contractor is to undertake a desktop and final detailed survey to ensure the works comply with the EMC regulations. The Contractor will be responsible for the works and for testing the installed works and identifying any further recommended works or remedial works.

Particular attention as part of desktop and final detailed surveys shall be given to the effects of the locations of the basement substations and basement comms room on other services and residents health i.e. provide EMC shielding between the following:

1. vertical electrical distribution.
2. horizontal electrical distribution.
3. IT / Data services running parallel to LV power services.
4. data transmissions systems running parallel to LV power services.

The Contractor shall be responsible for the successful installation, operation and completion of the engineering systems. The installation is to be fully co-ordinated and compatible with the project requirements as detailed within all Contract Documents.

DESIGN PARAMETERS

Ensure the system(s) are installed, tested and each type of equipment or material is selected to comply with all relevant British Standards (BS) a British Standard Institution recognised equivalent European Standard would also comply (see latest BSI Catalogue etc), other application guidelines in the specification and BS7671.

The latest edition of each British Standard and / or European equivalent shall be adhered to unless otherwise instructed. Where a revision is available over the design period, clarification must be requested and given by the project team for the basis of the installation and project responsibility. This shall include, but not limited to;

- The Electromagnetic Compatibility Regulations
- BS 7671 Requirements for electrical installations. IEE Wiring Regulations
- BS EN 61000 Electromagnetic compatibility (EMC). All parts and sections
- BS EN 50174 Information technology – cabling installation. Installation planning and practices inside buildings.

GENERAL

All systems shall be installed in accordance with the manufacturer's recommendations and EMC standards for equipment.

Provide screening for individual items of equipment where either the sensitivity of the equipment or its location dictates that screening protection is required.

Give careful attention to the locations selected for initial and future power, data and control equipment and distribution routes, to ensure all systems are not adversely affected by electromagnetic interference from other installed methods and systems. Specifically, use the following design criteria as a minimum:

(i) use galvanised steel conduit and trunking for all systems

(ii) fix power cables to separate cable trays from data systems. Avoid runs of power and data cabling in close proximity are to be avoided wherever possible. Where unavoidable, a minimum spacing of 300mm is to be provided, or such other spacing as may be determined from authoritative guidance as adequate to avoid interference. Wherever possible cross power and data at right angles

(iii) screen data cabling where appropriate

(iv) careful detailed co-ordination is to include, but not limited to the following systems:

- Low/high voltage routes
- Surrounding low voltage switch rooms and transformer substation.
- Electrical risers

- ITC, fire alarm, BMS, ELV, IRS, access control and surveillance and all other system cabling.

Give particular attention to overcoming the adverse effects which could be caused by transient conditions in the power system, e.g. motor starting, switching, generator start-up and running and step load changes. Confirm the power system distribution routes to ensure that such transient conditions are minimised as far as possible.

Reconfirm adequate space and access for installation, testing, maintenance and replacement remains available within all locations before procuring and installing any protective measures.

Where significant deviation from equipment positions and system requirement(s) depicted on the design intent drawings and / or project documentation appears necessary, consult the project team to verify the proposed arrangement remains acceptable and offer compliant alternatives, assist the design team where required to comply with this project requirement including supporting information as applicable.

The **IDNO** risers have been designed as solid walls, however, if there is a change in construction method the Contractor shall note the following typical Utility provider requirements which are to be allowed and followed;

Adequately align, support and fix all equipment to the structure in accordance with the equipment manufacturer's instructions.

Do not install electrical equipment until the building is watertight and internal structural work on walls and floors is substantially complete.

Protect from mechanical damage and from ingress of water, building debris and vermin, all equipment supplied in connection with this project. Maintain the protection continually throughout the works including periods of storage, installation and after installation.

Ensure the system(s) installation does not undermine the weatherproofing and waterproofing systems of neither roofs nor any other part of a building's fabric.

Provide full and detailed method statements for all aspects of the installation works including but not limited to builders work, plant erection, shutdowns, change-overs, testing and commissioning.

All site project requirements to be to the satisfaction of Building Control Officer, structural engineer, specialists, project team and Contract Administrator.

SYSTEM EQUIPMENT

Ensure all items of electrical equipment installed comply with the Electromagnetic Compatibility Regulations and standards as listed elsewhere in this document and shall carry the ‘CE’ mark.
Provide separate cable containment systems for controls and other signal cabling as described elsewhere in this document.

Systems affected by EMC effects are to include but not limited to the following:

- Incoming Telecommunication / Data Network
- ITC Installations
- Lighting Control
- Security, Access Control, Intruder Alarm and Surveillance systems
- Integrated reception system
- Fire detection and Alarm System

SYSTEM INSTALLATION

Adopt good installation practices so that disturbance coupled into systems will not exceed the systems immunity thresholds.

Upon practical completion and taking due account of the static system electrical load, employ an electromagnetic screening specialist to confirm in writing, compliance of the final electrical installation in accordance with BS EN 61000 for the fixed wiring installation.

Upon completion of the Contractors installation / working drawings and after issue to the project team and

Contract Administrator for review and comment, employ a specialist to complete a fully detailed EMI desktop study and background site survey(s) to establish any existing background EMI levels that may require further mitigation or design measures to minimise its effects.

The study is to relate to the confirmed cable and distribution routes, the main LV switchboards as shown by the Contractor in relation to the engineering systems installed, i.e. Comms, data logging systems i.e. MCB distribution boards, system panels etc, Control cables, Fire cables, Client equipment, systems associated with the project and the like.

Issue the specialists reports to the project team and Contract Administrator for review and comment prior to procurement and installation, clearly identifying any remedial works required and incorporate any mitigation measures findings therein as part of the Contractors works.

Allow at project completion(s) for site based investigations and site measurements to validate the desktop study(s). Document, record and allow for all project works, management and data collection.

Include all documentation to be included within the O&M's at project completion.

‘A’ Clauses

A10 – Project Particulars

110.001 THE PROJECT, BIM, ENVIRONMENTAL ASSESSMENT AND SOFT LANDINGS GENERAL REQUIREMENTS:

Refer to the scope of work and / or schedules for detailed project specific requirements.
Particulars of the project as a whole can be found in:

The main Contract Preliminaries.
General Scope of works

Building Information Modelling (BIM) requirements
Not Applicable

Soft Landings
Not Appllicable

Environmental assessment method applicable to the project
Not Applicable

Occupant wellbeing assessment method applicable to the project
Not Applicable

130.001 CONTRACT ADMINISTRATOR

The term 'Contract Administrator' (CA) is used within this specification. This person / organisation and their duties will be identified to all parties.

150.001 CLERK OF WORKS

Should any Clerk of Works be appointed their powers and duties will be made known to all parties.

150.003 (SERVICES) ENGINEERING SITE STAFF

Should any (Services) Engineering Site Staff be appointed their powers and duties will be made known to all parties.

150.004 DELEGATION

The Contract Administrator may delegate certain powers and duties. Details of these will be made known to all parties.

150.005 PRINCIPAL DESIGNER / PRINCIPAL CONTRACTOR

On Design and Build projects The Contractor's duties shall include the Principal Designer and Principal Contractor roles as defined in The CDM Regulations.

10000 Based on NES VERSION A10 Dec 19

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Refer to the scope of work and / or schedules for detailed project specific requirements.
Particulars of the project as a whole can be found in:
The main Contract Preliminaries.
General Scope of works

Building Information Modelling (BIM) requirements
Not Applicable.

Soft Landings
Not Applicable.

Environmental assessment method applicable to the project
SAP assessment

Occupant wellbeing assessment method applicable to the project
Not Applicable.

130.001 CONTRACT ADMINISTRATOR
The term 'Contract Administrator' (CA) is used within this specification. This person / organisation and their duties will be identified to all parties.

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Should any Clerk of Works be appointed their powers and duties will be made known to all parties.

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Should any (Services) Engineering Site Staff be appointed their powers and duties will be made known to all parties.

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10000 Based on NES VERSION A10 Dec 19

A11 – Tender and Contract Documents

110.001 THE TENDER DRAWINGS

The tender drawings are listed in the schedules.

140.001 PRE CONSTRUCTION INFORMATION

Comply with The Construction (Design and Management) Regulations 2015.
Details of the Pre-Construction Information are included in the Main Contract Preliminaries

150.000 INSPECTION

Drawings and other documents relating to the Contract generally may be inspected, by appointment, prior to the submission of tender.

As built documents may be inspected

10000 Based on NES VERSION A11 Dec 19

A12 – The Site / Existing Buildings

Incorporating C12 - Underground Services Survey

110.000 THE SITE / EXISTING BUILDINGS:

The site/existing buildings are described in the Main Contract Preliminaries.

120.000 SITE LOCATION

The project is located to the west of the existing village of Horton Heath, which sits between the local centres of Hedge End and Fair Oak, both within the Borough of Eastleigh.

130.000 EXISTING MAINS / SERVICES:

Underground services drawings shall be provided by Eastleigh Borough Council.
The Contractor shall undertake any additional survey work to define exact location of services before commencing work, if necessary.
Fully maintain all existing services described in the scope of works / system descriptions to existing premises during the progress of the Works.
Provide any additional work and materials necessary to maintain these services at all times during the duration of the Contract. Any existing services disturbed by the Works are to be reinstated fully in accordance with the standards of quality defined in the specification and to the satisfaction of the CA.
Make all connections to existing services out of normal working hours.

140.001 RISKS TO HEALTH AND SAFETY

The nature and condition of the site/building(s) cannot be fully and certainly ascertained before opening up.
The accuracy and sufficiency of any information provided by the employer or CA is not guaranteed and the Subcontractor must ascertain for themselves any information they may require to ensure the safety of all persons and the Works.

Comply with the requirements of the CDM Regulations by:

- compiling risk assessments for the sub-contract works.
- providing information on the sub-contract works which might affect the health or safety of any person.
- providing appropriate input to the Pre-construction Information, Construction Phase Plan and Health and Safety file for the works

150.001 BUILDING SERVICES SURVEY (NES C14)

Ascertain the nature of the site and all local conditions and restrictions likely to affect the execution of the Works.
Before commencing work, carry out a survey and examination of buildings, structure and engineering services affected by the works.
Examine all available drawings of the engineering services and report any discrepancies to the CA.
Refer to schedule A12sch2 for detailed project particular requirements of the survey.

170.001 SITE VISIT

Before tendering, ascertain the nature of the site, access thereto and all local conditions and restrictions likely to affect the execution of the Subcontract Works.

300.000 UNDERGROUND SERVICES SURVEY (NES C12)

Refer to schedule A12sch1 for project particular requirements.

300.011 CONTENT AND PRESENTATION OF UNDERGROUND SERVICES SURVEY:
(NES C12 300.010)

Undertake the survey in accordance with PAS 128.
The type, quality and details of the survey required for each category of underground service is detailed in schedule A12sch1.

300.021 STANDARDS AND LEGISLATION - UNDERGROUND SERVICES SURVEY:
(NES C12 300.020)

A12 – The Site / Existing Buildings

Carry out the underground services survey in accordance all applicable Statutory obligations arising from current legislation and regulations, together with other requirements. To include, but not limited to, the following, as applicable to the particular project and relating to the area of the site current at the date of tender.

HSG 47 - Avoiding Danger from Underground Services, 2014.
The Health and Safety at Work etc. Act 1974.
The Management of Health and Safety at Work Regulations 1999 as amended.
The Construction (Design and Management) Regulations 2015.
HSE L153 CDM Regulations 2015, Guidance on Regulations.
The Provision and Use of Work Equipment Regulations 1998 as amended.
The Electricity at Work Regulations 1989.
The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 as amended.
The Gas Safety (Management) Regulations 1996.
The Pipelines Safety Regulations 1996 (PSR) as amended.
The Gas Act 1995 and amendments made by Utilities Act 2000, .
New Roads and Street Works Act 1991and amendments made after 2002
Electricity Safety, Quality and Continuity Regulations 2002 as amended by The Electricity Safety, Quality and Continuity (Amendment) Regulations 2006 and The Electricity Safety, Quality and Continuity (Amendment) Regulations 2009.
Fire and Rescue Services Act 2004 as amended.
The Confined Spaces Regulations 1997
HSE L101 Safe working in confined spaces. ACOP and guidance (third edition, 2014).
HSE HSG264, Asbestos: The Survey Guide.
PAS 128:2014 Specification for underground utility detection, verification and location.
The Essential Guide to Utility Surveys Issue 4 (October 2011) published by The Survey Association
NJUG Volume 1 NJUG Guidelines on the Positioning and Colour Coding of Underground Utilities Apparatus.
NJUG Volume 2 NJUG Guidelines on the Positioning of Underground Utilities Apparatus of New Development Sites.
NJUG Volume 3 Guidelines on the Management of Third Party Cable Ducting
NJUG Volume 4 NJUG Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees.
NJUG Volume 5 NJUG Guidelines on Environmental Good Practice.
NJUG Volume 6 NJUG Guidelines on Co-ordination, Co-operation and Communication.

10000 Based on NES VERSION A12 Dec 19

130.001 PREPARATORY AND OTHER BUILDING WORK:

Enabling works comprising:

Not Applicable

Building Fabric Works comprising:

Air permeability and pressure testing of the building and any required re-testing in accordance with ATTMA technical standards "Measuring Air Permeability in the Envelopes of Buildings" - L1 (Dwellings) shall be undertaken by the Main Contractor.

Builders Work / Fire Stopping

The demarcation of responsibilities for builders work (including fire stopping) in connection with the engineering services as defined in the Main Contract Preliminaries shall be agreed with the Main Contractor during the tender period and clearly identified in the tender submission.
Refer to A13sch3 for project particular requirements.

Provision of certification stating:

The following shall be provided by the Main Contractor:
The building air permeability conforms to the requirements of the Building Regulations Part L2, Conservation of Fuel and Power or other equivalent requirements for Scotland, Wales and NI.
The thermal performance of the building envelope conforms to the requirements of the relevant section of the Building Regulations Approved Documents Part L1, Conservation of Fuel and Power or other equivalent requirements for Scotland, Wales and NI.

EPC is required to be provided by the designer (AECOM)

141.000 THE SUBCONTRACT WORK

This sub-contract covers the supply, installation, connection, testing, commissioning and setting to work detailed within the work sections / schedules of this specification and tender drawings including any builder's work that will not be undertaken by the Main Contractor.

Incorporate all equipment, accessories, controls, supports and ancillaries implicitly or explicitly required either by the specification and drawings, or in accordance with accepted current practice, and procedures, which after assembly, testing and commissioning will enable that section of the Works to function correctly and to achieve the specified performance.

Neither the specification nor drawings shall take precedence. Any apparent discrepancy between the specification and drawings, including the interface requirements between the BMS and packaged plant as detailed on the controls diagrams and individual plant schedules shall be drawn to the attention of the Contract Administrator before or with the tender submission. Otherwise the Contractor shall be deemed to have made the maximum allowance within their tender.

The system concept is for boreholes, manifolds, main headers and runs to properties (including isolation valves), to be addressed as individual work packages. Ownership of these packages and heat pump with associated ancillaries to be with energy services company.
As the project will be seeking funding from the Green Heat Network Fund and other potential funding sources, the subcontractors shall ensure that such standards that are required for compliance with these schemes are met.
The scope of the subcontract works shall include;

- Borehole installation and completion, including testing.
- Installation of header runs to manifold chambers, including testing.
- Connection to and installation of manifold headers to main headers, including testing.
- Installation of main headers (ring mains), including testing.
- Installation of runs to dwellings including individual building isolation points (subterranean), including testing.
- Runs to buildings including building penetrations in coordination with main contractor.
- Installation of heat pumps and ancillaries to comply with heat pump manufacturers guidance.
- Installation of heat exchangers, associated pumps and anxilliary equipment (these shall be priced separately within the tender documents)

- Testing, commissioning (including seasonal commissioning) and handover as per the appropriate sections of this specification.

150.000 WORK BY OTHERS AND CO-ORDINATION OF TRADES

Allow for co-ordinating the subcontract works with the works of other trades and installations which may be on site during the period of the subcontract.

200.000 GENERAL REQUIREMENTS

210.001 COMMON DESIGN CRITERIA

The criteria listed in the A13 Schedule of Common Design Criteria apply to all Work Sections included in the Contract unless specified otherwise.
Other design criteria applicable to particular equipment/systems are stated within the appropriate work section.

210.002 FIRE STOPPING

Refer to A13sch3 (Builders Work and fire stopping requirements) for project particular requirements.
Comply with BS 9999, relevant approved technical guidance to Building Regulations. Comply with BESA Technical Bulletin TB/032 for protection of pipework penetrating fire separating elements.
All components forming the seal system to be from the same manufacturer.
Provide a proprietary penetration seal system whenever possible, tested and assessed to BS EN 1366-3 and BS EN 1366-4 and classified to BS EN 13501-2. All products used, to have third party product certification by a scheme accredited by UKAS.
Only use UKAS accredited, third party installer certified specialist contractors. The specialists should be ASFP members and their certification must cover the passive fire protection element they are installing.
Install all fire stopping systems in accordance with the manufacturer's written instructions and the test/assessment/certification evidence provided by the installer / manufacturer of the penetration seal.
Support centres for services passing through penetration seals serving fire barriers to be the same as those covered by the test/assessment/certification evidence provided by the installer / manufacturer of the penetration seal.
Install and inspect fire stopping systems in accordance with Building Regulations (Approved Document B), ASFP Code of Practice TGD17 and the general best practice guidance given in the ASFP On-site guide to installing fire-stopping.
The contractor shall ensure all services requiring firestopping are installed and set out in line with testing requirements setting out of all sections of BS EN 1366 and all approved documents.
The Contractor shall also check that the proposed fire-stopping material is compatible with the services passing though and will not cause or result in an adverse impact or degradation of the service.

Contractor should check compatibility of fire-stop material, so that the compound does not result in a chemical or other reaction, which may degrade the service or containment. In particular, check for copper and some plastic materials

- Approved Document B2 - Fire Safety_2013.pdf
- Approved_Document B - Fire Safety_2019.pdf
- BS EN 1366-1-2014- Ducts.pdf
- BS EN 1366-2-2015-Fire Dampers.pdf
- BS EN 1366-3-2009-Penetration Seals.pdf
- BS EN 1366-4-2006+A1-2010-Linear Joint Seals.pdf
- BS EN 1366-5-2010-Service Ducts and Shafts.pdf
- BS EN 1366-6-2004-Raised Access and Hollow Core Foors.pdf
- BS EN 1366-7-2004-Conveyor Systes and their Closures.pdf
- BS EN 1366-8-2004-Smoke Extraction Ducts.pdf
- BS EN 1366-9-2008-Single Compartment Smoke Extraction Ducts.pdf
- BS EN 1366-10-2011+A1-2017-Smoke Control Dampers.pdf
- BS EN 1366-11-2018-Fire Protective Systems for Cable Systems and Associated Components.pdf
- BS EN 1366-12-2014+A1-2019-Non-mechancal Fire Barrier For Ventilation Ductwork.pdf
- BS EN 1366-13-2019-Chimneys.pdf

220.100 EXTERNAL NOISE CRITERIA

Building services plant noise level to comply with local planning / environmental authority requirements and statutory noise nuisance legislation.

Should the proposed plant be identified as having intermittent, tonal or otherwise characteristic features, a further applicable penalty should be subtracted from any of the proposed noise emission limits in line with requirements of BS 4142.

Unless detailed or scheduled elsewhere all services plant noise to be 5dBA lower (10dBA if tonal) than the otherwise prevailing background noise L_{90} levels when measured at a distance of 1m from the nearest noise sensitive window.

Unless detailed or scheduled elsewhere, on healthcare projects comply with the requirements of HTM 08-01 to limit external noise levels from services / plant rooms to achieve the following criteria.

Noise levels required by the local authority at the site boundary

The internal noise criteria.

Noise levels in external areas normally occupied by staff or the public of 50dB L_{A90} or no greater than the existing daytime background noise level.

230.100 INTERNAL NOISE CRITERIA:

Limiting noise levels for all types of areas as schedule of Common Design Criteria.

Unless detailed or scheduled elsewhere, on healthcare projects comply with the noise rating requirements of table 2 in HTM 08-01 for the total noise from mechanical and electrical services (including rainwater pipes) operating under normal conditions.

Agree the acceptable increase in internal and external noise levels for emergency plant with the users (normally + 10dB may be acceptable). Ensure sound insulation of rooms is not downgraded by the layout / installation of services.

240.001 ELECTRICAL SUPPLY

The definition of voltage levels used in this document are as follows:

High Voltage –	Voltages exceeding low voltage, as defined in The Electricity Supply Regulations 1988.
Low Voltage –	Voltages exceeding extra low voltage but not exceeding 1000V ac or 1500V dc between conductors, or 600V ac or 900V dc between conductors and earth, as defined in BS 7671.
Extra Low Voltage –	Voltages not exceeding 50V ac or 120V ripple free dc whether between conductors or to earth, as defined in BS 7671.

Where systems are specified as being maintained "under fire conditions" ensure wiring selected is suitable for the temperatures to be encountered.

Any electrical equipment supplied shall comply with the requirements of the Local Electricity Supplier and the limits for harmonics shall not exceed the limits stated in Engineering Recommendation G 5/4.

250.000 PLANT OPERATING CONDITIONS

Ensure all plant items are suitable for operation in the environment in which they are to be located.
Ensure all plant, motors, starters and ancillary equipment etc. are suitable for operation at full capacity under the specified conditions

260.000 ROOM TERMINAL LOCATIONS:

The positions of all connection points, accessories, apparatus, equipment and other room terminals shown on the tender drawings are approximate and for guidance in the preparation of the tender.
Agree, with CA, which terminals are subject to final positioning on site.
Allow for the movement of all such terminals up to a radius of 2.0m from the positions shown on the drawings.
Mounting heights indicated in tender documents are for tender purposes only. Confirm mounting heights with the CA before commencing work on site.

271.001 ELECTROMAGNETIC COMPATIBILITY AND ELECTROMAGNETIC FIELDS

Ensure all equipment and installations meet the requirements of relevant legislation:
- The Electromagnetic Compatibility Regulations 2016.
- The Radio and Telecommunications Terminal Equipment Regulations 2000 as amended.
- The Medical Devices Regulations 2002 as amended.
- The Supply of Machinery (Safety) Regulations 2008 as amended.

Ensure all equipment and installations are suitable for the electromagnetic environment in which they will operate:
- Electromagnetic environment zoning:
  - Conduct a study to validate the electromagnetic environment at each location.
- Domestic, commercial and light industrial environment:
  - Emissions BS EN 61000-6-3
  - Immunity BS EN 61000-6-1
- Industrial environment:
  - Emissions BS EN 61000-6-4
  - Immunity BS EN 61000-6-2
- Power station or substation environment:
  - Emissions BS EN 61000-6-4
  - Immunity BS EN 61000-6-5
- High-altitude Electromagnetic Pulse (HEMP) immunity:
  - Indoor equipment BS IEC 61000-6-6
  - Distributed infrastructure DD IEC/TS 61000-5-8

Ensure all systems and buildings are assessed for protection to, and that such protection meets the requirements of, BS EN 62305 and BS 7671 (IET Wiring Regulations) for surge protection and lightning protection.
Ensure electrical power installations comply with the electromagnetic compatibility requirements of BS 7671 (IET Wiring Regulations).
Ensure that earthing arrangements and earthing systems comply with BS EN 50310 and BS IEC 61000-5-2.
Ensure that telecommunications installations comply with BS 6701.
Ensure that data and control systems cabling infrastructure complies with BS EN 50174-series.
Ensure that records of installation practices used to achieve compliance with relevant legislation and standards, are maintained throughout design, installation and commissioning, and are provided in operation and maintenance information.
Validate electromagnetic compatibility of the completed works:
- Provide evidence of good EMC installation practices.
- Provide evidence of product conformity to relevant legislation and standards for electromagnetic compatibility, and suitability of the equipment for the zone(s) in which it is to be installed and used.
- Undertake measurements of electromagnetic emissions on completion, to demonstrate that emission levels are within the limits set by the relevant emissions standard for the electromagnetic environment within each zone.

Comply with the Control of Electromagnetic Fields at Work Regulations 2016 during the construction and commissioning of the works.
Ensure the completed works comply as necessary with the Control of Electromagnetic Fields at Work Regulations 2016.
Ensure that areas intended for general occupation and use, do not exceed the indirect-effect action levels and exposure limit values mandated in the Control of Electromagnetic Fields at Work Regulations 2016.

Ensure that the following are clearly identified in the Operation and Maintenance Manual and where appropriate the Health and Safety File:

All areas where the indirect-effect action levels and exposure limit values may be exceeded, and any relevant precautions, safe methods of work and personal protective equipment, that apply to those areas.
All operations and maintenance activities that may exceed the exposure limit values and/or indirect-effect action levels, along with recommended safe methods of work and personal protective equipment required.
All areas where electromagnetic fields exist that may affect employees at particular risk, including users of active and passive implanted medical devices, body worn medical devices or as a result of pregnancy.

290.000 SOFTWARE

Obtain on behalf of the end user all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Ensure that application software is written in compliance with BS ISO/IEC 26513 and BS ISO/IEC 26514.

Ensure that, as far as practicable, all software is commercially available off-the-shelf.

Ensure that any programmable configuration, customisation and bespoke software, is developed, tested and commissioned using relevant processes and procedures complying with BS ISO/IEC/IEEE 12207 or BS ISO/IEC/IEEE 15288, supported by a quality management system meeting the requirements of BS EN ISO 9001

300.001 EXPLOSIVE ATMOSPHERES:

Ensure that all aspects of the Works comply with relevant legislation including:

The Control of Major Accident Hazards Regulations 2015 (COMAH).
Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) 2002 as amended.
The equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016.

Employ relevant standards and guidance appropriate to the project particular scope of works in the design, selection, construction and erection of the Works:

BS EN IEC 60079/BS EN 60079 - series
BS EN 13463-2 - Non-electrical equipment for use in potentially explosive atmospheres. Protection by flow restricting enclosure
BS EN 13463-3 - Non-electrical equipment for use in potentially explosive atmospheres. Protection by flameproof enclosure
BS EN ISO 80079 / BS EN ISO/IEC 80079 - series
Association of Petroleum and Explosive Administration (APEA) / Energy Institute publication, Design construction, modification, maintenance and decommissioning of filling stations (Blue Book)
HSE L138 Dangerous substances and explosive atmospheres. Dangerous Substances and Explosive Atmospheres Regulations 2002. ACOP and guidance (second edition, 2013)

Hazard and operability (HAZOP) study

Where required and described in the project particular scope of works or schedules undertake a HAZOP - Comply with BS EN 61882 Hazard and operability studies (HAZOP studies). Application guide.

Ensure all equipment and installations are suitable for the explosive atmosphere zone in which they will operate.

Hazardous area zoning:

Conduct and document a risk assessment and study to ascertain and validate the hazardous area zoning in accordance with:

BS EN 60079-10-1 for explosive gas atmospheres
BS EN 60079-10-2 for explosive dust atmospheres
Association of Petroleum and Explosives Administration (APEA) / Energy Institute publication, Design construction, modification, maintenance and decommissioning of filling stations (Blue Book)
HSE L138 Dangerous substances and explosive atmospheres. Dangerous Substances and Explosive Atmospheres Regulations 2002. ACOP and guidance (second edition, 2013)

Electrical installations and systems

Ensure electrical installations and systems are designed, selected and erected in accordance with BS EN 60079-14 and BS 7671 (IET Wiring Regulations).

Ensure electrical installations and systems are designed to be maintained in accordance with BS EN 60079-17 and BS EN 60079-19.

Ensure intrinsically safe electrical systems and equipment comply with BS EN 60079-25.

Ensure equipment and other products conform to relevant parts of BS EN IEC 60079/BS EN 60079, BS EN ISO 80079 / BS EN ISO/IEC 80079 series and BS EN 13463 for the zone(s) in which they are to be installed and used.

Ensure electrostatic hazards are controlled in accordance with PD CLC/TR 60079-32-1.

Provide evidence of conformity to the relevant legislation for the completed Works:

Provide evidence of product conformity to relevant legislation and standards for explosive atmospheres, and suitability of the equipment for the zones(s) in which it is to be installed and used.

310.000 CYBER SECURITY AND DATA PROTECTION:

Ensure that all systems and software provided to this specification facilitate the end user's compliance with the Data Protection Act 2018.

Standards:

Relevant parts of BS EN 61508 functional safety for electrical/electronic/programmable electronic safety-related systems

BS IEC 62443-3-3 and BS EN IEC 62443-4-1 security requirements industrial automation and control systems

BS 7799-3, BS ISO/IEC 15408-1, BS ISO/IEC 15408-2 and BS ISO/IEC 15408-3 for evaluating and assuring IT security risks.

BS ISO/IEC TR 13335-5 for management of network security.

PAS 555:2013.

IET Code of Practice for Cyber Security in the Built Environment

Ensure systems are designed, so far as practicable, to be sufficiently robust to cyber-attack.

Ensure systems are designed, so far as practicable, that they fail safely when compromised.

Ensure systems include for information security monitoring, measurement and analysis in accordance with BS ISO/IEC 27004

Ensure that all software, configuration and system integration activities are implemented, tested and commissioned using relevant information technology security management processes and procedures complying with BS EN ISO/IEC 27000, BS EN ISO/IEC 27001 and BS EN ISO/IEC 27002.

Ensure systems are protected against cyber security threats prior to handover.

Ensure all necessary provisions are in place to prevent unauthorised access to systems, equipment and software prior to taking over.

Ensure all operatives involved in testing of security-related environments and systems are screened in accordance with BS 7858.

Ensure that software and firmware updates can be applied to ensure continued security of the delivered systems.

Provide software and firmware roadmaps for all products.

Unless detailed elsewhere in this specification, ensure software and firmware is supported for at least 10 years following handover.

Provide a software and firmware support and maintenance strategy for all delivered systems.

Ensure all systems and software are audited for compliance in accordance with BS ISO/IEC 27007 and PD ISO/IEC TS 27008, by a company certified to BS ISO/IEC 27006.

10000 Based on NES VERSION A13 Dec 19

140.001 PRODUCT GUARANTEES AND WARRANTIES

Comply with the following and the main contract preliminaries.

Product guaranties and warranties provided by manufacturers, shall be valid or be extended up to the end of the Defects Liability Period.

Any product guaranteed or warranted by a manufacturer for a period of time which extends beyond the end of the defects Liability Period shall remain under guarantee or warranty up to the end of the extended period.

Copies of all guarantees or warranties include in each Operation and Maintenance Manual and hand over one additional set on or before Practical Completion.

10000 Based on NES VERSION A20 June 17

200.000 PRICING/SUBMISSION OF DOCUMENTS

230.001 PRICING OF PERFORMANCE SPECIFIED WORK:
Ensure tenders include for all work necessary to meet the requirements for the Performance Specified Work and its completion and proper integration with the Works generally.

290.001 PRICING OF SPECIFICATION AND DRAWINGS:
Alterations and qualifications to the specification and drawings must not be made without the written consent of the CA. Tenders containing such alterations or qualifications may be rejected. Costs relating to items in the specification that are not priced will be deemed to have been included elsewhere in the tender.

331.001 A SCHEDULE OF RATES
A schedule of rates based on the rates used to build up the Tender must be submitted within one week of request. The schedule must include all significant items of work. The rates are to include Contractors cash discount, unless this is not applicable. These rates will be used to value all variations.

360.000 PROGRAMME
Submit a proposed programme showing the sequence and timing of the principal parts of the Works, periods for planning and design and itemising any work which is excluded. Refer to A32 for requirements.

362.000 ORGANISATION LINE DIAGRAM:
Submit with the tender an organisation line management diagram produced specifically for the project.
The management diagram to include all key personnel identified in clause 364.000

364.000 SCHEDULE OF KEY PERSONNEL:
Submit with the tender a schedule of key personnel who will manage, engineer and deliver the project from pre-construction to the end of the defects period.
The same personnel should be involved at all stages of the project. Where this is not possible this shall be indicated in the schedule with reasons why.
As a minimum the schedule should include the following:

Project Director
Project Manager
Drilling Contractor/Specialist
Mechanical design engineer
Public health design engineer
Electrical design engineer
Data / communications engineer
Acoustic specialist
Commissioning manager
Site manager

366.000 OPERATING PROCEDURE STATEMENTS:
Submit with the tender a set of company standard operating procedure statements.

370.001 METHOD STATEMENTS
Submit method statements describing health and safety considerations and showing proposals of how it is intended to execute the Works generally and provide separate method statement(s) for the following specific parts thereof:

- Resourcing and execution of design duties applicable to the project
- Testing and commissioning of all systems in the Works
- Chlorination
- Pre – commissioning flushing and cleaning of pipework systems
- Water Treatment
- Systems Removal
- Any off site testing of plant
- To address identified risks
- Demonstration to statutory authorities

Submit method statements on request and not less than 20 working days prior to commencement of the activities covered by the statement.

390.000 ALTERNATIVE MANUFACTURERS/SUPPLIERS

In addition to and at the same time as their tender for the Subcontract Works as defined in the tender documents, the Subcontractor may, at their discretion, submit alternative manufacturers or suppliers for consideration. Alternatives which would involve significant changes to other work will not be considered.
Such alternative(s) must include all additional costs arising from necessary changes to the details of the installation, including changes to the design and drawings, as well as any associated ancillary equipment items.
Such alternative(s) is/are deemed to be alternative tender(s) and each must include a complete and precise statement of the effects on cost and programme.
Full technical data for each such alternative must be submitted with the Tender together with details of any consequential amendments to the design and/or construction/installation of other parts of the Works.

400.001 SELECTION OF MANUFACTURERS/SUPPLIERS

Where manufacturers, suppliers or installers of products are NOT identified by name, select products that comply in all respects with the specification and, as and when requested, demonstrate such compliance. These alternative suppliers shall operate a quality management system which complies with the requirements of BS EN ISO 9001

Where manufacturers, suppliers or installers of products are identified by name, or names, but no reference is made to "Or approved equivalent" use these exclusively.
Where manufacturers, suppliers or installers of products are identified by name, or names, but reference is made to "Or approved equivalent" alternatives may be selected and shall be submitted to the CA for approval. These alternatives shall operate a quality management system which complies with the requirements of BS EN ISO 9001

Check that any proposed alternatives comply with any stated British (or other equivalent recognised International) Standards. Confirm equivalence in quality, operation and space requirements to those items which have been specified by name. If, and when requested demonstrate the proposed alternative is fully equivalent to the specified item and identify any constructional, cost, programme, maintenance or other differences.
Obtain formal authorisation, by issue of an 'Instruction', i.e. incorporating any alternative into the Works.

Where applicable all pressure equipment plant and assemblies shall be compliant with The Pressure Equipment (Amendment) Regulations 2015 and The Pressure Equipment (Safety) Regulations 2016. The manufacturer (or manufacturer's agent) shall as a minimum:
Categorise their product depending on the type of equipment, state the fluid and nature of fluid.
Determine which conformity assessment module is appropriate.
Ensure their products satisfy essential safety requirements.
Construct and maintain a technical file.
Issue a declaration of conformity.
CE mark appropriate products.

410.000 PROPOSED MANUFACTURERS, SUPPLIERS AND SPECIALISTS

Submit with tender a list of proposed manufacturers, suppliers and specialist installers / contractors upon which the tender is based.
The list shall include, as a minimum, all main plant items, terminal heating, cooling and ventilation devices, luminaires together with specialists for BMS/ controls, fire alarms, water treatment, systems flushing and cleaning, communications / data, security commissioning and testing and lifts.
The list shall include all items for which the choice of manufacturer/supplier/ specialist is at the discretion of the contractor.
The list shall indicate where an alternative to the preferred manufacturer, supplier or specialist identified in this specification has been proposed.

430.000 QUALITY CONTROL METHOD STATEMENT AND RESOURCES

A statement must be submitted with the Tender describing the organisation and resources which the Subcontractor proposes and undertakes to provide to control the quality of the Subcontract Works. The statement must include the number and type of staff responsible for quality control, with details of their qualifications and duties.

440.000 HEALTH AND SAFETY INFORMATION

Submit a statement with the tender describing the organisation and resources which the Subcontractor proposes and undertakes to provide to safeguard the health and safety of operatives, and of any person who may be affected by the Subcontract works, including a copy of the subcontractors health and safety policy document, including risk assessment procedures.

450.000 RISKS TO HEALTH AND SAFETY

Submit a statement with the tender describing any significant and unavoidable risks which may arise as a result of carrying out the subcontract works and the measures proposed to safeguard the health and safety of operatives and of any person who may be affected by the Subcontract/works.

460.000 MAINTENANCE CONTRACT DURING THE DEFECTS LIABILITY PERIOD

Submit with the tender a supplementary proposal for the maintenance of all equipment throughout the defects liability period generally in accordance with BESA SFG20, with a contractual form of agreement as detailed in schedule A37sch1 for the following:

- Include for maintaining the installation in efficient working order including routine checks, adjustments, lubrication and replacement of consumable spares, etc.
- It should set out the terms of the offer, the work to be carried out, the guarantees of performance and the price of the first 12 months after Practical Completion of the Works or Section thereof.
- The proposal will be considered as part of the tender for the Subcontract Works. However the Employer may not undertake to accept it.

500.000 SUB-SUBLETTING

520.000 SUB-SUBCONTRACTORS

Where the Subcontractor proposes to sublet any portion(s) of the Subcontract Works a list must be submitted with the Tender.

The list will define such portion(s) and give, for each, the name and address of the proposed Sub- subcontractor.

10000 Based on NES A30 TEXT Dec 19

A31 – Provision, Content and Use of Documents

100.000 DEFINITIONS AND INTERPRETATIONS

120.000 DEFINITIONS

The definitions of technical terms associated with the engineering services installations are those included in CIBSE, IOP and BSRIA Technical Publications
Loss Prevention Council – Rules for Automatic Sprinkler Installations
BS 7671 – Requirements for Electrical Installations (IET Wiring Regulations).
British Standards, including Codes of Practice.
Associated Statutory Acts.

Where used in the documentation the following definitions shall apply

Duct -An enclosed space specifically intended for the distribution of services, with direct access for personnel.

Trench -A covered horizontal service space in the floor or ground with access from above.

Cavity -A space enclosed within the elements of a building within which services are installed, e.g. the space between ceiling and floor above. See Building Regulations.

Service Areas -Includes areas within a building with limited finishes such as loading bays, car parks etc.

Concealed Services - Includes installations within ducts, trenches cavities.

Exposed Services- Includes installations within plant rooms, outdoors or unprotected within "service" or occupied areas.

System - System means all equipment, accessories, controls, supports and ancillary items, including supply, installation, connection, testing, commissioning and setting to work necessary for that section of the Works to function.

Services - Services means the inclusion of one or more system.

Drawing definitions are generally in accordance with the latest edition of BSRIA BG6, see clauses 150.001 to 183.000.

130.000 REFERENCES TO BSI DOCUMENTS

References to BSI documents are to the versions and amendments listed in the British Standards Catalogue and in subsequent issues of BSI News up to and including the date of Tender.

140.000 MANUFACTURERS' REFERENCES

Manufacturers' references are those current at the time of preparation of the Tender documents.
References mean the particular product as specified in the manufacturer's technical literature current at that time.

150.001 TENDER DRAWINGS

Tender drawings means drawings listed in the Schedules.
The tender drawings show the general arrangement of the Engineering Services to be provided and the inter-relationship of the Works with work to be installed by others.

The drawings are accordingly part diagrammatic, with runs of piping, ducts and cableways being shown to small scale and not necessarily indicating exact installation positions.

The drawings do not necessarily show dimensions required to construct the works, nor do they accurately locate every item of equipment or plant ancillary which does not affect the visual impact of the completed works.

The drawings do not detail the building fabric or structure whether new or existing, nor are they necessarily based upon survey information.

160.000 DRAWINGS DEFINITIONS GENERALLY

The following clauses define concept sketch drawings, concept schematics, developed design drawings, developed schematics, technical design drawings, builder's work information, co-ordination/co-ordinated working drawings, installation drawings, builder's work details, manufacturer's drawings and record drawings. The definitions are from the latest edition of BSRIA BG 6 with the exception of Controls Logic Diagrams and Switchgear and Starter and Control Instrumentation Panel Drawings.

160.001 BIM USE ON THE PROJECT:

Not Applicable

161.000 CONCEPT SKETCH DRAWINGS

Line diagrams and layouts indicating basic proposals, connections to incoming services and utilities, locations of areas of central plant, location and extent of main vertical and horizontal distribution routes in such detail as to illustrate the incorporation of the engineering services within the project as a whole and with respect to any zoning.

161.005 CONCEPT SCHEMATICS

Line diagrams indicating main items of plant and their interrelationships, including incoming services and utilities in such detail as to illustrate the incorporation of the engineering services within the project as a whole.

162.000 DEVELOPED DESIGN DRAWING

A drawing showing the extent of the services installations. The main features of developed design drawings should be as follows:

Plan layouts to a scale of at least 1:100 with key areas at 1:50.

Show the extent and types of services terminals visible within the occupied space. Alternatively these can be quantified and scheduled either as a tag on the drawing or as a separate schedule of room data sheet.

Show approximate locations of horizontal and vertical service runs.

Show main plant and distribution system sizes, particularly those affecting spatial allocation, while acknowledging that these may need some adjustment and refinement in the operation of the technical design drawings and equipment schedules.

Pipework and electrical containment represented by single line layouts. Ductwork represented by either double line or single line layouts as required to demonstrate that the routes indicated are feasible (this should be supplemented with key sections / elevations). Symbols and lines conventions in accordance with either a recognised standard (ISO of BS), or a supplied legend.

Show how space within risers and service zones is allocated to M, E and PH services.

Where appropriate these drawings should indicate typical room / area details to show key principles of the systems within or serving them.

162.005 DEVELOPED DESIGN SCHEMATICS:

Line diagrams describing the interconnection of components in a system showing the engineering principles. The main features of a developed schematic drawing are as follows:

The drawings should include all the functional components that make the system work, such as main plant distribution, inline equipment supporting engineering performance, terminal plant providing HVAC performance.

Quantities of performance-specified components should only be indicative with accurate quantities on schedules or similar.

Symbols and line conventions in accordance with a recognised ISO or BS standard or supplied legend.

Label the drawings with appropriate pipe, duct, busbar and cable sizes, pressures and flow rates. These details may be subject to adjustment during the technical design and construction stages.

Indicate components which have a sensing, control or measurement function.

The major components indicated on the schematic drawings should be identified for cross-referencing purposes.

Where appropriate these drawings should indicate typical room / area details to show key principles of the systems within or serving them.

163.000 TECHNICAL DESIGN DRAWING:

A drawing showing the intended locations of plant items and service routes in such detail as to indicate the design. The main features of technical (detail) design drawings should be as follows:

Plan layouts to a scale of at least 1:100.

Plant areas to a scale of at least 1:50 and accompanied by cross-sections and elevations as appropriate.

The drawing will not indicate the precise position of services, but it should nevertheless be feasible to install the services within the general routes indicated. It should be possible to produce co-ordinated working drawings or installation drawings without major rerouting of the services. The design must also consider procurement and installation methodologies.

163.002 TECHNICAL DESIGN SCHEMATICS:

Line diagrams describing the interconnection of components in a system showing the engineering principles. The main features of a Technical Design schematic drawing are as follows:

The drawings should include all the functional components that are to be installed. This includes main plant distribution, inline equipment, terminal plant and components, control components.

Symbols and inline conventions in accordance with a recognised ISO or BS standard or a supplied legend.

The drawings should be labelled with appropriate pipe, duct, busbar, cable sizes and fault levels, pressure and flow rates. These details may be subject to adjustment during the construction stage.
The major components indicated on the schematic drawings should be identified for cross-referencing purposes.
Where necessary, control methodologies such as load shedding and capacity.

163.005 BUILDER'S WORK INFORMATION:

A drawing to show the provisions required to accommodate the services which significantly affect the design of the building structure, fabric and external works.
Drawings (or schedules) of work to be carried out by building trade and required to be costed at the design state e.g. plant bases.
Drawings to show requirements for building works necessary to facilitate the installation, maintenance and where appropriate the future replacement of the engineering services (other than where it is appropriate to mark out on site).
Drawings shall include for any temporary works to allow installation of the services to the programme

164.000 CO-ORDINATED WORKING DRAWINGS:

Drawings showing the inter-relationship of 2 or more engineering services and their relation to the structure and building fabric. The main features of a co-ordinated drawing are as follows:

Plan layouts to a scale of at least 1:50, accompanied by cross-sections to a scale of at least 1:20 for all congested areas.
The drawing should make allowances for installation, commissioning, maintenance and replacement working space and methodologies.
The drawing should be spatially co-ordinated and there should be no physical clashes between the system components when installed. Critical dimensions, datum levels and invert levels should be provided.
The spaces between pipe and duct runs shown on the drawing should make allowance for the service at its widest point. Allow for insulation, standard fitting dimensions and joint widths on the drawing.
Indicate positions of main fixing points and supports where they have significance to the structural design or spatial constraints.

165.001 INSTALLATION DRAWING:

A drawing based on the Technical Design drawing or co-ordinated working drawing with the primary purpose of defining that information needed by the tradesmen on-site to install the works.
Ensure such drawings relate where relevant to builders' work, architectural, structural and other drawings and site surveys.
The main features of installation drawings should be as per co-ordinated working drawings plus:

Allowances for inclusion of all supports and fixings necessary to install the works.
Allowances for installation details provided from manufacturers' drawings.
Allowances for plant and equipment. This includes any alternatives to the designer's original specified options that have been chosen.
Space for associated support systems, installation, methodologies and access for maintenance and replacement.

Where co-ordinated working drawings have not been produced, the installation drawing should include co-ordination.

166.000 INSTALLATION WIRING DIAGRAM:

Drawing showing the interconnection of electric components, panels etc in accordance with the design intent indicated in the schematic drawings and incorporating the details provided on manufacturer's certified drawings.
Indicate the following: maximum electrical loading for each supply cable; cable termination facilities; and cable identification and all terminal numbers.

166.005 BUILDER'S WORK DETAILS:

Drawings to show requirements for building works necessary to facilitate the installation of the engineering services.
Unless agreed otherwise, the following can be marked out on-site.
Holes less than the threshold agreed by the team.
Electrical socket and switch boxes
Openings that are best cut into blockwork or partitions

168.000 MANUFACTURER'S DRAWING
Drawing prepared by a manufacturer, fabricator or supplier for a particular project and which is unique to that project. Examples include drawings for ductwork, pre-fabricated pipework, sprinkler systems, control and switchgear panels and associated internal wiring, pre-fabricated plant, customised plant and equipment.

169.000 MANUFACTURER'S CERTIFIED DRAWING
Drawing provided by a manufacturer or supplier to indicate details of the product, components or plant items and which the manufacturer or supplier guarantees the supplied equipment will comply with.

170.001 RECORD DRAWING
Drawing showing the building and services installations as installed at the date of practical completion. The record drawings shall be as defined in A37 and below.
Drawing showing the building and services installations as installed at the date of practical completion. The main features of the record drawings should be as follows:
Use a scale not less than that of the installation drawings.
Include locations of all the mechanical, electrical and public health systems and components installed including ducts, pipes, cables, busbars, plant items, pumps, fans, valves, dampers, control devices, strainers, terminals, electrical switchgear and components, security and fire sensors and control components.
Labelled with appropriate pipe, duct and cable sizes, pressures and flow rates.
Have marked on the drawings the positions of access points for operating and maintenance purposes.
The drawings should not be dimensioned unless the inclusion of a dimension is considered necessary for location.

180.000a CONTROLS LOGIC DIAGRAMS / DRAWINGS
Tender drawings and/or schematic details of all main plant items and associated control components showing the conceptual arrangement of the plant with each item identified together with a description of the controls operation and details of the associated interlocking. Where terminal units are included on the controls diagrams they show the "typical" control requirements for each unit. The Controls Specialist shall establish actual quantities of terminal units and associated control components from the detail design drawings and/or equipment schedules.

181.001 SWITCHGEAR, STARTER AND CONTROL INSTRUMENTATION PANEL DRAWINGS
Drawings showing the construction and internal wiring diagrams of the starters, panels and/or other devices.

181.002 WIRING/CONNECTION DIAGRAMS
Drawings, diagrams or schedules detailing interconnections between control panels, motors, control components, etc.

182.000 AS-INSTALLED DRAWINGS
Drawings/records retained on site to record the progress of and any site modifications to the Works including any changes to software.

183.000 PLANTROOM SCHEDULES AND SCHEMATICS
Drawings or schedules as defined in A37.

190.000 EXAMINATION OF DRAWINGS/INFORMATION
The CA will examine the propositions submitted for compliance, in principle, with the design intent.
Such an examination shall not relieve the originator of such documents of their responsibilities and obligations under the contract.

200.000 DOCUMENTS PROVIDED ON BEHALF OF THE EMPLOYER

200.005 CONTRACT DOCUMENTS
Contract documents means those documents, including drawings and specifications, on which the contract for the Works is based.

201.000 INTERPRETATION OF DOCUMENTS
Drawings provided to a scale of 1:50 or smaller and/or expressed in symbolic terms or which are in diagrammatic format, give indicative locations only and details of components are not to be inferred.

Arrangements shown on Tender Drawings are intended to indicate layout to be generally adhered to, but actual routes of services are to be such as to ensure the neatest possible arrangement.
Notify the Contract Administrator of any conflict of information arising from the use of the specification or drawings.

300.000 DOCUMENTS TO BE PROVIDED AND DESIGN ACTIVITIES BY SUBCONTRACTOR

300.005 ALLOCATION OF RESPONSIBILITIES
Notwithstanding the requirements to provide information indicated in clauses 310.001, 320.001 and work section A37 (regarding handover documentation) certain responsibilities on the project shall be as detailed in schedule A31sch2. The activities in the tables have generally been taken from appendix A in BSRIA BG6. The item numbers refer to the items in the BSRIA document and are therefore not necessarily sequential as the complete listing has not been included. Should any of the items clash with other contractual information, inform the CA during the tender.

310.001 DESIGN AND PRODUCTION INFORMATION
Complete the design and detailing of the work additional to that incorporated in the Tender documents and provide complete production information (including, as appropriate, fabrication/ installation drawings, design calculations, specifications, etc.) based on the drawings, this specification and other information provided, liaising with the CA, Principal Designer, Contractor and others as necessary to help ensure co-ordination of the work with related building elements and services.

Request additional information as necessary from the CA and/or Contractor and provide information as necessary in time to meet the programme.

Submit sufficient copies of the design/production information as specified.
Submittals will be examined for compliance in principle with the design intent. Such examination shall not relieve any responsibilities and obligations under the contract or mean that the CA is responsible for the correctness of the submittal or its suitability for purpose.
The CA will record their comments and return to the Subcontractor who shall make any necessary amendments without delay

If submitted design/production information differs from the requirements of the Subcontract documents each such difference must be brought to the attention of the CA, supported by all relevant information.
Prior to submission check and approve all drawings, schedules and any other information provided by manufacturers, nominated suppliers or specialist sub-subcontractors to ensure that all the requirements of the contract documentation have been incorporated. Accompany all documents submitted with a certificate indicating that they have been checked by the Subcontractor.

Submittals will be returned indicating A, B or C action
Status A – No Comment, Status B – Minor Comment, Status C – Rejected.
Documents, which are Status “C”, must be re-submitted. Unless and until it is confirmed that resubmission is not required, resubmit for further checking and comment, and incorporate any necessary amendments all as before.

320.001 DRAWN AND OTHER INFORMATION

Provide drawn information for the Client/design team in (hard copy print / electronic PDF or /CAD) form, numbers of copies as scheduled below.

Type of drawing	Initial comment	Construct/ Final	Commiss’g	Record (Paper)	Record (Electronic)
Concept Sketch drawings	(Electronic)				
Concept Schematics	(Electronic)				
Developed Design drawings	(Electronic)	(Electronic)	(Electronic)	2(A3)	1
Developed Schematics	(Electronic)	(Electronic)	(Electronic)	2(A3)	1
Technical Design drawings	(Electronic)	(Electronic)	(Electronic)	2(A3)	1
Technical design schematics	(Electronic)	(Electronic)	(Electronic)	2(A3)	1
Co-ordinated working drawings	(Electronic)	(Electronic)	(Electronic)	2(A3)	1
Installation drawings	(Electronic)	(Electronic)	(Electronic)	2(A3)	1
Installation Wiring Diagrams	(Electronic)	(Electronic)	(Electronic)	2(A3)	1
Builderswork information	(Electronic)	(Electronic)	(Electronic)	2(A3)	1

Manufacturer drawings	(Electronic)	(Electronic)	(Electronic)	2(A3)	1
Control Logic diagrams	(Electronic)	(Electronic)	(Electronic)	2(A3)	1
Electric Panels drawings	(Electronic)	(Electronic)	(Electronic)	2(A3)	1
Record	(Electronic)	(Electronic)	(Electronic)	2(A3)	1
Plantroom Schedules	(Electronic)	(Electronic)	(Electronic)	2(Framed)	1
Plantroom Schematics	(Electronic)	(Electronic)	(Electronic)	2(Framed)	1

Where Record Drawings are to be CAD confirm format with CA

330.000 PREPARATION OF DOCUMENTS

Prepare drawings to commonly recognised scales generally on A1 sheets and details and schedules on A4 sheets.

Prepare electrical drawings in accordance with BS EN 61082-1.

340.001 SYMBOLS

Use symbols and line conventions generally as Tender Drawings. Agree additional notation before preparing drawings.

350.000 DOCUMENT NUMBERING/REGISTRATION SYSTEM

Agree with the CA the document numbering/registration system to be used before preparing any documents.

370.001 TECHNICAL LITERATURE

The Contractor is required to keep copies of any relevant manufacturers' installation or technical literature readily accessible for reference by all supervisory personnel.

380.001 MAINTENANCE INSTRUCTIONS AND GUARANTEES

Retain copies delivered with components and equipment or obtain from manufacturer as necessary and hand over to CA on or before Practical Completion.

10000 Based on NES A31TEXT Dec 19

120.000 CO-OPERATE

Co-operate with the Contractor, other subcontractors, suppliers, local authorities and statutory undertakings in the execution of their work.

130.000 PROGRAMME/PROGRESS

Provide a programme for the Contract Works.

Due allowance is to be made in the programme(s) for the Works for, but not limited to, the following:

Ordering and installation periods.

The completion of drawing, etc. including the 20 days working days for comment

Work resulting from instructions issued in respect to the expenditure of provisional sums.

Concurrent work by other trades.

Any temporary works necessary for the completion of the engineering services installations.

Pre-commissioning, commissioning and performance testing of the engineering services installations.

Preparation and provision of Record Drawings and Operating and Maintenance Manuals.

Provide programme information as resource loaded tracking Gantt chart or PERT diagram unless specified otherwise elsewhere in the specification or main contract preliminaries.

Provide a separate and detailed commissioning programme for agreement with the CA. Make due allowance for the following:

Commissioning, demonstration and instruction procedures.

Provision of written notice before each (or series of) test, inspection, commissioning or demonstration procedures are to be carried out

Demonstration to the CA that test instruments and equipment are accurate.

131.000 COMMISSIONING PROJECT MANAGEMENT:

Undertake Commissioning Management in accordance with CIBSE commissioning code M.

Compile a detailed commissioning programme and confirm/agree with the main contractor.

Complete and submit to the project supervisor the appropriate health and safety method statements and risk assessments.

Establish a means (such as checklists) of monitoring the progress of the commissioning.

Ensure that all parties involved in the commissioning process have documentation procedures for dealing with variations to contract. Ensure that a control mechanism is set up which includes documentary backup of what has been changed, how and why.

Establish a consistent numbering system to identify work items.

Ensure the consistent use of mnemonics to identify all BMS components and devices.

Ensure regular database and configuration backups are made throughout all stages of the commissioning process.

Ensure attendance of all appropriate and responsible parties for interface pre-commissioning tests (interface between BMS and other plant items/systems).

136.000 INSTRUCTIONS

Apply for instructions, drawings, etc. in writing, in good time.

140.000 ASSESSMENT AND MONITORING

Record progress of the Works weekly on a copy of the programme kept on site.

Update programme without delay if any circumstances arise which affect the progress of the Works.

Mark up "As Installed" details weekly and before any work is hidden from view.

Where required, environmental assessment of project to meet the criteria for the target rating under the relevant BREEAM Scheme.

Where required, assessment of the project in terms of wellbeing-related features to meet the criteria for the target level of achievement /level of certification under the WELL Building Standard.

150.000 INSPECTION AND MEASUREMENT OF WORK

Provide all necessary assistance to enable CA to examine or measure the Works.

160.000 COVERING-UP

Ensure no section of the Works are covered, concealed insulated until completion of a witnessed satisfactory test.

Give not less than 10 working days' notice when Works which are to be covered or concealed are ready for examination and/or measurement.

170.000 STATUTORY AUTHORITIES

Orders for the incoming services will be placed by the Main Contractor unless detailed otherwise in the scope of works .

Liase with the Statutory Authorities and provide any test notices required to ensure final connections are made in accordance with the requirements of the testing and commissioning programme

180.000 TEST NOTICES

Provide all formalities in connection with Test Notices, Agreement and Application for Supply Forms etc.
Ensure all documents requiring the Employer's signature are forwarded to the CA in time to meet the building programme in order for the necessary test and supply arrangements to be made.
No additional payments will be made for expenses incurred due to reconnections, re-visits etc., by Supply Authorities or any other officials.

10000 Based on NES A32TEXT Dec 18

130.000 SUBCONTRACTOR'S PERSON-IN-CHARGE
Appoint a foreman-in-charge and/or site agent to ensure constant management and supervision of the Subcontract Works.
Give maximum possible notice before changing the foreman-in-charge or site agent.

140.000 DIMENSIONS
Where installations are dependent upon site dimensions ensure that these are available before proceeding with the Works.
Do not take dimensions by scaling from the drawings.
Where dimensions are indicated on drawings or schedules check these on site, as appropriate, to ensure building construction and manufacturing tolerances can be accommodated.
Do not order or manufacture equipment using dimensions indicated on the Tender drawings, specification or schedules.

145.000 ASSESSMENT AND MONITORING:
Record progress of the Works weekly on a copy of the programme kept on site. Update or redraft programme without delay if any circumstances arise which affect the progress of the Works.
Mark up "As Installed" details weekly and before any work is hidden from view.
Where required, environmental assessment of project to meet the criteria for the target rating under relevant BREEAM Scheme.
Where required, assessment of the project in terms of wellbeing related features to meet the criteria for the target level of achievement / level of certification under the WELL Building Standard.

150.000 SETTING OUT FOR THE SUBCONTRACT WORK
Where this is done by the others check its accuracy and obtain their approval before proceeding with the work.

160.000 SITE MODIFICATIONS
Do not make site modifications to assemblies without authorisation.
Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions. Ensure that modifications made comply with any type test certificate obtained for arrangement of components.

170.000 BREEAM AND WELL REQUIREMENTS:
On appropriate projects and specified elsewhere.

Comply with requirements for all targeted BREEAM credits and supply relevant information to the BREEAM Assessor. Targeted credits will be as agreed with the client and BREEAM assessor/advisor.

Comply with the requirements for all relevant WELL Building Standard features. Targeted features will be as agreed with the client and WELL AP.

170.001 STANDARDS AND REGULATIONS
Provide all materials and works in accordance with the appropriate British Standard or Code of Practice current at the time of tender and where no BS or CP is applicable the Agrement Certificate for the particular item.
Provide products in accordance with the Construction Products Regulations (CPR). Products covered by harmonised European product standards (hENs) must have a Declaration of Performance (DoP) certificate for the product and be CE marked. Manufacturers of products not fully covered by a hEN or which do not fall within the scope of a hEN shall provide Declaration of Performance documentation in accordance with one of the methods in the CPR.
Comply with all statutory instruments and regulations, and local bylaws relating to the area of the site current at the date of tender.
Comply with the requirements of the Local Authority Building Inspector.
Comply with all relevant requirements included in the Main Contract Preliminaries

Comply with all Statutory Obligations arising from current legislation and regulations, together with other requirements, including, but not limited to, the following as applicable to particular projects

2. Statutory Obligations and codes of practice
3. For Building Regulations refer to clause A33:172.000
4. Health and Safety at Work etc. Act 1974
5. HSE L8 Legionnaires' Disease. The Control of Legionella Bacteria in Water Systems ACOP and all parts of HSG274 (for technical guidance). Where required produce risk assessments in accordance

with BS 8580-1.
6. HSE L5 Control of Substances Hazardous to Health. ACOP and guidance (sixth edition, 2013).
7. The Electricity at Work Regulations 1989 as amended and HSE HSR25 Guidance on Regulations (third edition, 2015).
8. Management of Health & Safety at Work Regulations 1999
9. HSE L8 Legionnaires' Disease. The Control of Legionella Bacteria in Water Systems ACOP and all parts of HSG274 (for technical guidance).
10. HSE L5 Control of Substances Hazardous to Health. ACOP and guidance (sixth edition, 2013).
11. Gas Safety (Installation and Use) Regulations 1998
12. HSE L56 Safety in the Installation and Use of Gas Systems and Appliances: Gas Safety (Installation and Use) Regulations 1998. Approved Code of Practice and guidance (fifth edition, 2018).
13. The Gas Appliances (Enforcement) and Miscellaneous Amendments Regulations 2018.
14. The Gas (Meters) Regulations 1983 as amended.
15. The Measuring Instruments Regulations 2016 as amended.
16. The Petroleum (Consolidation) Regulations 2014.
17. The Control of Pollution (Oil Storage) Regulations 2001 as amended.
18. The Pipelines Safety Regulations 1996 and amendments
19. HSE L82 Guide to the Pipelines Safety Regulations 1996.
20. Pressure Systems Safety Regulations 2000 as amended
21. HSE L122 Safety of Pressure Systems. Pressure Systems Safety Regulations 2000. ACOP and guidance (second edition, 2014).
22. Pressure Equipment (Amendment) Regulations 2015 and The Pressure Equipment (Safety) Regulations 2016.
23. The Confined Spaces Regulations 1997
24. HSE L101 Safe work in confined spaces. Confined Spaces Regulations. ACOP and guidance (third edition, 2014).
25. Work at Height Regulations 2005
26. The Energy Performance of Buildings Regulations (England and Wales) Regulations 2012 and amendments.
27. The Ecodesign for Energy-Related Products Regulations 2010 as amended.
28. The Renewable Heat Incentive Scheme Regulations 2018 and the Domestic Scheme Regulations 2014, both as amended.
29. England and Wales - The Water Supply (Water Fittings) Regulations 1999 as amended, the Water Act 2014 and The Construction Products Regulations 2013.
30. Scotland - The Water Supply (Water Fittings) Byelaws 2014.
31. Northern Ireland - The Water Supply (Water Fittings) Regulations 2009.
32. Building (Inner London) Regulations 1987, as amended.
33. The Electricity Act 1989 as amended.
34. The Electricity at Work Regulations 1989
35. The Electricity Safety, Quality and Continuity Regulations 2002 and current amendments.
36. Factories Act 1961 and current amendments.
37. Clean Air Act 1993 and current amendments.
38. The Environmental Protection Act 1990 and current amendments.
39. Air Quality Standards Regulations 2010 appropriate to project location.
40. The Fluorinated Greenhouse Gases Regulations 2015 as amended.
41. The Workplace (Health, Safety and Welfare) Regulations 1992
42. HSE L24 Workplace health, safety and welfare. ACOP and guidance (second edition, 2013).
43. The Construction (Design and Management) Regulations 2015.
44. The Health and Safety (Display Screen Equipment) Regulations 1992 as amended
45. HSE L26 Work with display screen equipment. Health and Safety (Display Screen Equipment) Regulations 1992 as amended (Miscellaneous Amendments) Regulations 2002. Guidance on Regulations (second edition, 2003).
46. The Clean Air (Arrestment Plant) (Exemption) Regulations 1969 (Wales only).
47. The Control of Substances Hazardous to Health (COSHH) Regulations 2002, as amended
48. HSE L5 Control of Substances Hazardous to Health. ACOP and guidance (sixth edition, 2013).
49. HSE L8 Legionnaires' Disease. The Control of Legionella Bacteria in Water Systems ACOP and all parts of HSG274 (for technical guidance).
50. Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) 2002 as amended.
51. HSE L138 Dangerous substances and explosive atmospheres. Dangerous Substances and Explosive Atmospheres Regulations 2002. ACOP and guidance (second edition, 2013).
52. The Control of Major Accident Hazards Regulations 2015 (COMAH).
53. The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres

Regulations 2016.
54. CLP - Classification, Labelling and Packaging of Substances and Mixtures, Regulation (EC) 1272/2008, and amendments.
55. Control of Asbestos Regulations 2012 as amended
56. HSE L143 Managing and working with asbestos. Control of Asbestos Regulations 2012. ACOP and guidance (second edition, 2013).
57. The Provision and Use of Work Equipment Regulations 1998 (PUWER) as amended.
58. HSE L22 Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. ACOP and guidance (fourth edition, 2014 as amended).
59. Personal Protective Equipment at Work Regulations 1992
60. HSE L25 Personal protective equipment at work. Personal Protective Equipment at Work Regulations 1992. Guidance on Regulations (third edition, 2015).
61. The Lifting Operations and Lifting Equipment Regulations 1998 (LOLER) as amended
62. HSE L113 Safe use of lifting equipment. Lifting Operations and Lifting Equipment Regulations 1998. ACOP and guidance (second edition, 2014 as amended).
63. The Equality Act 2010 and current amendments.
• BS 8300-1 and BS 8300-2
65. The Electrical Equipment (Safety) Regulations 2016
66. The Control of Electromagnetic Fields at Work Regulations 2016.
67. The Electromagnetic Compatibility Regulations 2016.
68. The Radio and Telecommunications Terminal Equipment Regulations 2000 as amended.
69. The Medical Devices Regulations 2002 as amended.
70. The Supply of Machinery (Safety) Regulations 2008 as amended.
71. Public Utility Company and/or Statutory Authority regulations, specifications, and requirements.
72. Other Requirements
73. British Standards and Codes of Practice.
• BS 7671 - Requirements for Electrical Installations (IET Wiring Regulations).
• BS EN 50110 series - Operation of Electrical Installations.
76. Relevant parts of BS EN ISO 14122 for general requirements for safe access.
77. Comply with the recommendation in BS 8560 for incorporating safe work at height into the design of buildings during the design process.
78. When the provision of ducts in buildings for services forms part of the scope of works, comply with BS 8313 for the design, construction and installation of ducts and installation of services in the ducts.
79. When ground source heat pump systems are involved in the works, comply with,
80. Ground Source Heat Pump Association – Environmental good practice guide for ground source heating and cooling
81. Ground Source Heat Pump Association – Vertical Borehole Standard OR Thermal Pile Standard OR Shallow Ground Source Standard as applicable
82. British Drilling Association – Code of Safe Drilling Practice
83. British Drilling Association – Guidance on Managing the Risk of Hazardous Gases when Drilling or Piling Near Coal if applicable
84. Microgeneration Certification Scheme – MIS 3005: Heat Pump Systems if applicable
85. Microgeneration Certification Scheme - Specification for Ground Source Closed-Loop Drilling
86. International Ground Source Heat Pump Association – General Code of practice for closed loop installations
87. Insurance Company Requirements.
88. IEC Standards.
89. This specification is based on UK and European Standards, to achieve an approach for safety and compatibility for electrical, data network and information technology installations, and equipment, aligning with the European Committee for Electrotechnical Standardisation (CENELEC) approach.
90. Identify any instances where the proposed solution does not conform to the above.

Public Utility Company and/or Statutory Authority regulations, specifications, and requirements.
With regard to Gas Act 1986 and the Electricity Act 1989 (consolidated under the Utilities Act 2000) and supporting regulations. Under this legislation where a meter is used to measure the amount of energy supplied for billing purposes, the meters must be of a type verified and approved by OFGEM. In addition, for electricity supplies to domestic customers by licensed suppliers, a certified meter must be used.

All *"equipment"* (mechanical and electrical) that could represent a potential ignition source intended for use in potentially explosive atmospheres must comply with the ATEX Directive 94/9/EC, which is enacted by "The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations, 2016" and "The Dangerous Substances and Explosive Atmospheres Regulations 2002"

A33 – Quality Standards / Control

The term *"equipment"* (with reference to the ATEX directive) is defined 'any item which contains or constitutes a potential ignition source and which requires special measures to be incorporated in its design and/or its installation in order to prevent the ignition source from initiating an explosion in the surrounding atmosphere.' Also included in the term "equipment" are safety or control devices installed outside the hazardous area but having an explosion protection function. "Protective Systems" are defined as items that prevent an explosion that has been initiated from spreading or causing damage. They include flame arresters, quenching systems, pressure relief panels and fast-acting shut-off valves.

Comply with the requirements of the Local Authority Building Inspector. Comply with the requirements of the latest version of Approved Documents L1A/B of The Building Regulations and Part 6 of the Technical Standards in Scotland and all 2nd and 3rd tier documents referred to in these documents.

Notify all authorities in accordance with their regulations and obtain any required approvals for the installation.

Where no specific design, performance or installation standards are quoted the following shall apply:

CIBSE and BSRIA Guides.
CIBSE Codes of Practice / commissioning codes.
CIPHE Plumbing Engineering Services Design Guide.
CIBSE (SLL) Code for Lighting and SLL Lighting Guides.
CIBSE Technical Reports.
CIBSE Technical Memoranda.

Ensure all equipment and systems are designed and installed in accordance with the relevant standards and that operational compatibility exists between the systems and any other system installed at the same location.
Supply plant and equipment to achieve the specified design conditions and to provide stable control.

In the absence of specific design, performance or installation standards being stated seek the instructions of the CA prior to commencement of the Works and with adequate time so as not to cause delay.

When new editions, versions and amendments are published during the construction, seek the instructions of the CA with respect to any modifications or changes necessary.

When applicable, comply with requirements for all targeted BREEAM credits and supply relevant information to the BREEAM Assessor. Targeted credits will be as agreed with the client and BREEAM assessor/advisor.

170.002 SUITABILITY OF MATERIAL AND PRODUCTS:
Use materials and products which:

are new unless specified otherwise.
are suitable for the services and conditions of use normally expected to apply after the installation is complete.
are able to withstand the testing and commissioning conditions specified.
do not initiate mould growth, support vermin, contain animal hair, contain crocidolite or support bacterial life.
do not involve the use of CFC's at any stage of manufacture, installation or subsequent operation except where specified.
are free from objectionable odours of the maximum or normal working conditions of operation.
do not suffer deterioration at the maximum or specified conditions of operation.
are capable of being applied to a base surface without causing damage or deterioration of the base.
are not a fire hazard, and do not evolve dense or toxic fumes when subjected to excessive heat, such as a fire.
when of similar type, are made by the same manufacturer.
whenever possible ensure products are manufactured and/or stocked under one of the following:

BSI Kitemark Scheme
BSI Safety Mark Scheme
from Firms of Assessed Capability to BS ISO 9001
from Stockists of Assessed Capability to BS ISO 9001

170.003 DELETERIOUS MATERIALS

No material generally known to be deleterious are to be used in, or incorporated into, any temporary or permanent Works forming part of the Project.

In particular none of the following items are to be used

: Asbestos or asbestos based products
: Urea formaldehyde or materials which may release formaldehyde in quantities which may be hazardous with reference to the limits set by the HSE
: Material containing fibres less than three microns diameter or 200 microns long
: Lead or any material or product containing lead which may be ingested, inhaled or absorbed
: Polychlorinated biphenyl
: Fibres not sealed or otherwise stabilised to ensure that migration is prevented
: Vermiculite containing fibrous dust
: Polytetrafluoroethylene (IPTFE) except for pipework jointing

Any other products or materials which are generally known within the Building Industry to be deleterious or hazardous to health or safety or to the durability of the property in the circumstances in which they are used including:

: High alumina cement and/or concrete
: Woodwool slabs used as permanent shuttering
: Calcium chloride in admixtures for use in reinforced concrete
: Sea-dredged aggregates for use in reinforced concrete which do not comply with current British Standards
: Aggregates for use in concrete which do not comply with current British Standards
: Alkali reactive aggregates
: Calcium silicate bricks or materials

The Contractor shall check with the manufacturers and/or suppliers of products and materials that any specified product contains such material. If any specified product contains such material, the Contractor shall request and alternative specification of product or manufacturer.

170.004 SAMPLES

Submit samples as detailed elsewhere to the Contract Administrator. Retain on site until the completion of the contract.

The samples shall not be used in the final installation.

172.000 BUILDING REGULATIONS:

The engineering services design, installation, testing and commissioning shall comply with the latest version of Buildings Regulations / Approved Documents or Technical Handbooks and any supplementary guidance, including all amendments, based on the project location. For the UK devolved nations all relevant equivalent documents shall apply.

Where specific reference is made to Building Regulations and / or particular Approved Documents in some specification work sections the text is based on Building Regulations or Approved Document applicable to England. Where the project is in one of the UK devolved nations, then the equivalent documents used by that nation shall apply.

180.000 TYPE TESTS

Provide certificates of verification of type tests. Ensure that drawings and other documents forming part of certificate are available prior to any order being placed.

190.000 TEST CERTIFICATES

Where testing specific to the project is required, ensure test certificates include:

Project title.
Details and date of test.
Instruments used, serial numbers, calibration dates.
Signature of those witnessing test.
Contractor's name.
Specific location of the item in the Works.

200.000 INSPECTION AND TESTS – ON OR OFF-SITE

Submit schedules showing those parts of the Works for which inspections and tests are required in the specifications, to substantiate conformity with the Specification and for which records are required to be maintained.
Should any alternative item be proposed which does not carry appropriate certification, ensure independent testing is carried out at no expense to the Employer to confirm compliance.
Where required, provide formal method statements supported by risk assessments detailing the procedures for carrying-out on site tests.
Agree in advance with all parties procedures for inspections and tests including periods of notice.
Where a test indicates non-compliance with the Specification submit immediately details of the non-compliance and proposals for corrective action.
Arrange access for personnel who require to be in attendance, to manufacturer's or other off site premises when any inspections and tests carried out.
Attendance or otherwise of the supervisory personnel during specified inspections or tests will not reduce the obligations or restrictions of the Contract.
Carry out all tests required by legislation under the direction of a "competent person".

210.000 INSPECTIONS AND TEST RECORDS

Prepare a set of drawings and/or report sheets to record accurately the test and inspection information including the following.

Plant identification, section and installation under test.
Manufacturer's reference number.

Date, time, duration of test, weather conditions.
Test results with itemised readings including records of all other checks and tests.

Maintain records of all specified inspections and tests performed including third party and works test certificates.
Include in records, as appropriate, details of the element, item, batch or lot, the nature, number and date of the inspections and tests, the number and type of deficiencies found, any corrective action taken and other relevant particulars.
Maintain all records on site for inspection. On completion of the Works, include copies in the operating and maintenance manuals.
Comply with the requirements of latest version of Approved Documents L1 / L2 of The Building Regulations.
Submit copies of records within one week of request.

220.001 TESTING AND COMMISSIONING OF SERVICES

Use commissioning specialists who are members of The Commissioning Specialist Association (CSA).
Agree a programme for pre-commissioning checks, setting to work, commissioning and performance testing, and allow for all costs incurred.
Comply with the requirements of the latest version of Approved Documents L1 / L2 of The Building Regulations.
Where an existing system has been extended or modified, then, unless noted otherwise in the scope of works, the complete system shall be re-commissioned
During commissioning systems shall not be left running without Contractor attendance on site eg overnight or during weekends. Should a component failure occur the engineering services shall be configured to safely shut down.
Where required, provide formal method statements supported by risk assessments detailing all commissioning procedures.
Give not less than twenty working days' notice and state any requirements for the attendance and co-operation of others.
Provide all necessary facilities to enable tests to be witnessed and inspections carried out either on site or at manufacturer's works.
The CA will only witness test proceedings, confirm recorded results and determine if the specified requirements have been satisfied. If following test or inspection of any plant or part thereof is shown to be defective or not conforming to the specification the CA will reject such defective parts by written notice, within reasonable time, indicating area of dispute.
Appoint a "Commissioning Manager" to oversee the whole of the testing, commissioning, performance testing and instruction of client's staff.
Provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.
Where Dry Riser and Wet Rise firefighting mains are installed comply with the requirements of BS 9990 Clause 7.2 for buildings under construction.

Test all equipment, material and systems as detailed in Work Sections, Reference Sections and Schedules. If an inspection or test fails, repeat the procedure, until satisfactory results are obtained.
Complete all tests before any paint, cladding or similar materials are applied or before services are concealed.
Ensure all requirements such as cleanliness, protection from harmful external and internal elements etc. are provided prior to commencement of commissioning.
Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust, as necessary, to meet the specified design requirements.
Provide all necessary instruments and recorders to monitor systems during commissioning and performance testing.
Provide test equipment subject to a quality assurance procedure complying with BS ISO 10012-2.
Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed to the satisfaction of the CA.
Maintain on site full records of all commissioning and performance testing, cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual.
Provide all certification documents for approval by the CA before any system is offered for final acceptance.
Gas, fuel oil, electricity and water for testing and commissioning will be provided by the main contractor.
Upon successful completion of performance tests the works shall be thoroughly cleaned and returned to as new condition.
On completion / handover provide a notice to the Local authority confirming that the building services have been commissioned in accordance with requirements of the latest version of Building Regulations Approved Documents ADL1 & ADL2.

230.000 COMMISSIONING PROCEDURES

Observe the following requirements when commissioning the Engineering Services.
Progressive static testing will be witnessed by the CA when work is presented for testing. This will include

- Insulation resistance tests.
- Earth fault loop impedance tests.
- Earth continuity tests.
- Pipeline pressure tests.
- Air Ductline Pressure Test

Carry out pre-commissioning examination and testing to ensure that each system or item of equipment is complete, in a safe condition and all notices are displayed. "Completion" for operational purposes implies the bulk of snagging has been offered to the CA and that remedial work has been completed. All fans, pumps etc. tested for operation, polarity, phase sequence and impedance etc.
Prepare commissioning programme, taking into account site progress and availability of related services, and agree access required for controls etc.

240.000 OPERATIONAL DEMONSTRATION

Provide a written statement to the CA confirming that each installation has been correctly tested and commissioned and that the performance requirements can be achieved.
Demonstrate to the CA that all system components are operating correctly, and the completely integrated installation will function in accordance with the specified performance requirements.
Carry out performance testing of air-conditioning systems in both summer and winter conditions. If the building not provided with cooling carry out performance testing of the heating systems in winter conditions and demonstrate that the building does not “overheat” as defined in the basis of design or current Building Regulations.
If a BMS is installed this shall comprise setting the BMS to provide a 7 day log of the following parameters:
Air intake and discharge temperature and humidity at all plant.
Ambient air temperature
Space temperatures in all areas.
Heating and chilled water flow and return temperature
Terminal unit heating and chilled water demand
The log shall be triggered when the ambient air temperature reached design condition.
If a BMS is not installed the Contractor shall submit alternative proposals to achieve this requirement. Provide a log-book and record all hours run.

250.000 OUTSTANDING ACCEPTANCE TESTS

Any items which have failed their acceptance tests or where such tests are delayed by the client are to be listed and dates agreed, during the defects liability period when reasonable loads are available.

260.000 SYSTEMS USED BEFORE PRACTICAL COMPLETION

Systems may not, without the prior written approval of the CA be used before Practical Completion.
Systems to be used before practical completion for the benefit of the Contractor and/or Subcontractor must have all consumable elements (including lamps and tubes) replaced by new not more than seven days prior to Practical Completion.
No system shall be put into use prior to handover to the employer, except for testing and commissioning, unless in accordance with the following procedure:
Following the receipt of written instructions, the Subcontractor shall operate designated parts of the Subcontract Works, provided that such operation is practicable and does not prejudice the Subcontractor's responsibilities and obligations under the Subcontract.

Additionally and with adjustment to the Subcontract sum, the Subcontractor, shall if instructed, provide:
Comprehensive insurance including indirect loss for any plant being operated, maintenance of the installation, re-instatement of the installation to "as new" condition prior to handover to the Employer.
Allow the defects liability period to commence on handover.

300.000 OPERATION OF SYSTEMS BEFORE THE PRODUCTION OF RECORD DRAWINGS AND/OR OPERATING AND MAINTENANCE MANUALS

Provide attendance, at no expense to the Employer, to put into service, operate 24 hours a day and maintain the systems to the Employer's requirements, including the provision of suitable competent labour, in the event that the Record Drawings and/or Maintenance Manuals are not available when the Works would, in the opinion of the CA, otherwise qualify for Practical Completion.
In the event of the Subcontractor failing to provide this service satisfactorily the Employer shall be entitled to make their own arrangements and recover the full cost through the Contract.

310.000 INSPECTION BY EMPLOYER'S INSURANCE COMPANY

Where indicated in the Work Sections items are to be inspected by a "competent person" acting for the Employer's Insurance Company appointed under the provisions of the Factories Act 1961 or other relevant legislation. The installations concerned shall satisfy the Insurance Company's requirements in all respects.
Agree a programme for inspection and certification of specified equipment.
Inform the CA when equipment is to be ready for examination.
The Employer will place an order with the Insurance Company. Details and nature of the order will be provided to all interested parties.
Provide all detailed drawings etc. of the equipment to enable the Insurance Company to approve design before manufacture.
Arrange for the attendance of the Insurance Company's Engineer/Surveyor at each stage of manufacture and installation and provide all necessary access and facilities for inspecting and testing as may be required.
No plant which is subject to "inspection" will be accepted on behalf of the employer until a satisfactory certificate has been received by the Employer from the Insurance Company.
All Insurance Company charges for examination and approval of drawing, inspection of works during construction and inspection and certification of the completed work will be paid by the Contractor.

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115.000 CDM REGULATIONS

Comply with the requirements of the CDM Regulations 2015 by:

adhering to the rules of the Pre-Construction information and Construction Phase Plan.
reporting accidents, injuries or dangerous occurrences to the main contractor.
providing the main contractor with appropriate input to the health and safety plan, including risk assessments, and to the health and safety file.
providing the main contractor with information on the subcontract works which might affect the health or safety of any person.

120.000 DELIVERY

Provide adequate and safe protection for all materials and products during transport to site.
Deliver all ductwork, tubes, conduit, trunking and associated equipment with open ends effectively plugged, capped or sealed.

130.000 HANDLING

Offload and transport about the works all materials and products in a manner as recommended by manufacturers/suppliers.

140.000 STORAGE

Store all materials and products as recommended by manufacturers.
Provide sufficient, safe and secure storage for all materials and products.
Provide racks to prevent distortion for storage of conduits, pipes and similar materials.
Store all fittings, accessories and sundry items in clean bins or bagged and stowed in racks and maintained under suitable weatherproof cover.

151.000 PROTECTION OF SUBCONTRACT WORKS

Provide adequate and safe protection for all materials and products during and after installation.
Ensure all items are protected against ingress of water and dust, formation of condensation, extremes and rapid changes of temperature, building works and operations of others.
Protect during erection all easily damaged materials with, as a minimum, hardboard covers, and until the area is proven to be weathertight, heavy duty polythene sheet. Such items include but are not limited to:

control panels,
switchboards,
distribution boards,
heater batteries,
finned pipework,
gauge glasses,

Protect all finished items from damage and paint splashes. Install items such as grilles, diffusers, light fittings, switches, accessories etc. as near to completion as practicable.
Install filter media only when the plant items concerned are being commissioned and tested.
Cap all open ends of pipes, ducts, conduit and trunking etc. except when being worked upon.
Leave plant and equipment in a ready to paint condition where specified as part of the Works or to be carried out by others.
Paint parts liable to corrosion immediately after removal of any temporary protection.
Replace material, plant or equipment where deterioration or damage has occurred prior to handover.

160.000 IDENTIFICATION

Where appropriate, ensure that materials, plant and equipment bear the brand name, serial/batch number and any other data required to identify their nature in relation to the Works.

170.000 MOVING PARTS

Immediately prior to Practical Completion adjust, ease and lubricate moving parts as necessary to ensure easy and efficient operation.
Ensure that, whenever necessary, temporary supplies are provided during construction to enable motive plant items delivered and/or installed to be run at regular intervals to avoid damage or deterioration.
Ensure that rotating plant is hand-turned periodically if temporary supplies are not available.

10000 Based on NES VERSION A34 Dec 19

A50 – Products By / On Behalf of the Employer

110.001 PRODUCTS PROVIDED BY THE EMPLOYER:
Details of such products are given in the relevant work sections.
Advise Contract Administrator not less than 2 months before the date such products are required on site. Advise of revised dates to suit any changes to the contract programme.
Take delivery, mark receipts and take into appropriate storage. Advise the CA of details and number of items received.
Once products provided by or on behalf of the Employer are in the possession of the Subcontractor all conditions of the Contract and technical specifications are applicable to such items, including all requirements for protection, storage, distribution, fixing, insurances, replacement if damaged/stolen/lost etc. painting, identification, setting to work and commissioning.

120.001 WORKS
Details of Works by or on behalf of the Employer are given in the relevant work sections.
Advise the Contract Administrator of any requirements related to the contract programme.

10000 NES VERSION
Based on NES A50 TEXT D

P30 – Trenches/Pipeways/Pits for Buried Engineering Services

100.010 PERFORMANCE OBJECTIVES

To provide excavation, backfill, beds and surrounds for buried pipelines, cables and ducts other than ordinary drainage pipelines.
To lay ducts for telecommunications and data cables.
To provide stop valve surface boxes, access chambers, draw pits and inspection chambers and the like.
To permanently reinstate roads and paths affected by excavations.
All work on underground services shall be in accordance with the guidance in HSG47 – Avoiding danger from underground services

Positioning and planning of utilities shall be in accordance with the latest revision of the following NJUG Guides and specific Part 3 clauses in this specification:

Volume 1: NJUG Guidelines on Positioning and Colour Coding of Underground Utilities
Volume 2: NJUG Guidelines On The Positioning Of Underground Utilities Apparatus for New Development Sites
Volume 3: NJUG Guidelines on the Management of Third Party Cable Ducting
Volume 4: NJUG Guidelines for The Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees
Volume 5: NJUG on-site environmental good practice guidelines

PART 3 SPECIFICATION CLAUSES SPECIFIC TO P30

300.000 GENERAL

300.010 SUPPLY AUTHORITY REQUIREMENTS:
Ensure all system components are approved by the appropriate Supply Authority and installed in accordance with their requirements. Arrange for them to inspect and approve installations as they proceed.

300.021 ROUTES OF SERVICES BELOW GROUND:
Based on the approximate locations indicated on the drawings, agree precise locations with the CA. Set out trenches clearly and accurately. Locate with temporary marker posts. Excavate trenches taking due care of existing services in the vicinity, carefully setting aside any materials required for backfilling or reinstatement. Ensure that the minimum cover for services is achieved at all times taking into account the location and levels of existing services.

Trench
Allow common trench for all underground services where appropriate.

300.030 SUPPLY OF PIPE DUCTS:
Supply PVC pipe and cable ducts as indicated on the drawings.

300.061 SERVICE CABLE AND PIPE DUCTS: [NES 300.060]
Lay ducts in the formation shown, on newly prepared bedding. Joint ducts in accordance with the manufacturer's instructions.
Ensure that ducts slope no more than 1:60 vertically and 1:30 horizontally.
Ensure that pre-formed duct bends used at ends of duct routes meet the requirements of the cable manufacturer for bending radii.
Prove alignment of completed duct run by drawing through a mandrel 7mm diameter less than nominal duct bore for minimum length 250mm. Clean completed duct run by drawing through a circular wire brush 12mm diameter more than nominal duct bore.
Install a draw wire of corrosion resistant material and minimum breaking strength 550N in each empty duct.
Plug and seal all ducts with proprietary duct plugs, on completion.

310.000 PRODUCTS/MATERIALS

310.020 BEDDING & BACKFILL:
Application - External Services

Lay external services on 100 mm imported soft sand. Cover and provide 100mm minimum cover of imported soft sand prior to back filling.

Bed and surround ducts generally with 100 mm single sized 10 mm aggregate to BS EN 12620. Lay and compact uniformly in 100 mm layers.
Bed and surround ducts in 150 mm Concrete to BS 8500-1 / BS EN 206.
20mm aggregate sulphate resisting where necessary, where under roads.
Backfill generally with selected fill, free from vegetable matter, rubbish, frozen soil and excluding lumps and stones retained on a 40mm sieve. Thoroughly compact by hand in layers not exceeding 100 mm.
Backfill under roads with granular sub-base material type 1 to Manual of Contract Documents for Highways Works Vol 1 Clause 803.
Cover newly laid cables with 100mm of bedding material.
Lay cables on newly prepared bedding. Ensure multiple layers of cable are separated vertically by a 50mm layer of hard rammed bedding material. Cover newly laid cables with 100mm of bedding material.
Following back filling permanently re-instate all retained road and footpath surfaces, landscaping, channels, kerbs and edgings etc. and to their previous condition. ie to all areas that are outside of the site boundary.

310.030 ACCESS/INSPECTION CHAMBERS/DRAW PITS:
Provide as indicated on the drawings.
Construct as indicated on the drawings.

320.000 WORKMANSHIP

320.001 STRUCTURES:
Ensure pipes in and out of structures are as short as possible. Surround by concrete at least 150mm thick. Set pipes sufficiently steep to prevent the possibility of differential settlement causing a backfall.

320.002 BACKFILLING OVER CONCRETE:
Do not start backfilling within 24 hours of placing concrete. Do not use heavy compactors and prevent imposition of traffic loads within 72 hours of placing concrete.

320.003 TEMPORARY BRIDGES:
Provide temporary bridges over trenches as necessary to prevent construction traffic damaging pipes after backfilling.

320.011 SERVICE TRENCHES: (NES 300.050)
Provide service trenches to allow the services to be installed, including any separation, in accordance with:

- BS 7671 IET Wiring Regulations
- BS EN 50174-3 - Information technology. Cabling installation. Installation planning and practices outside buildings.
- The appropriate regulations associated with water supply to the building(s).
- The Gas (Installation and Use) Regulations 1998 and IGEM Transmission and Distribution (TD) Series Standards.
- OFTEC Technical Book 3, BS 5410-1 for installations serving domestic buildings up to 70kW output capacity.

Width to be as small as practicable with sides vertical.
Remove mud, rock projections, boulders and hard spots from trench bottom and trim level.
Carry out walk over survey of trench route, trial hole any area considered to be potentially difficult. Submit report of survey and trial holes and re-plan service routes after survey and trial holes if required.
Establish locations of any other underground service adjacent to service route.
Carry out any indicated work to adjacent services if necessary.
Inform Architect / CA in advance to give them reasonable opportunity to inspect trench for each section of the work.
Excavate trench carefully setting aside any materials required for backfilling or reinstatement and remove excess excavated material from site.
Clear trench bottom of loose stones and place bedding to full width of trench.
Grade trench bottom to a maximum slope of 1:12.
Layout and identify services as NJUG guidelines for positioning and colour coding of underground utilities apparatus.
Carry out all work in adopted streets to comply with the New Roads and Streets Works Act 1991 and associated codes of practice.

320.020 LAYING PIPES/PIPEDUCTS/UTILITY SERVICES:
Use slings that do not damage either pipe or coating. Thoroughly inspect pipes prior to slinging.

Do not lower pipes until the trench bottom has been approved to receive the pipes. Ensure pipes are in correct alignment and orientation, concentric with the pipes already laid.
Make joints in accordance with manufacturer's instructions using the proprietary materials indicated.
Use a purpose made adapter for joints between pipes of different materials. If none is available, abut the pipes, tape and seal the gap, surround by 1/2 sections or less for 1m either side of the joint and surround in C20 concrete 150mm thick for 2m either side of the joint.
Install PVC-U pipes and fittings in accordance with BS EN 1401

Lay straight to line, true to gradient or level on an even, continuous bed of the specified bedding material, laid over full width of trench. Provide draw ropes where required.
Protect from damage and ingress of debris, temporarily seal all exposed ends during construction.
Inform Architect / CA and service utilities or subcontractors to give them reasonable opportunity to inspect installation prior to backfilling.
Lay and compact further bedding material to a level not less than 100 mm above crown of pipe.

320.021 BEDDING, PROTECTION AND BACKFILL PIPEWORK:
Make cavities in the bedding to facilitate sling removal. Elsewhere smooth the trench bottom. Prepare one full pipe length in advance of pipelaying.
Locate interfaces between backfilled materials to the weaker material side of theoretical.
Concrete is the strongest and selected fill the weakest. Lay all fill less than 300mm above the top of the pipe barrel in 150mm layers and hand compact. Above this level layers may be 225mm. Over 1m above top of pipe mechanical compaction may be used

320.025 CABLE TRENCHES:
A 100mm depth tolerance shall be included when digging trenches, therefore all services shall be at the depth indicated below plus 100mm. This will allow for the possibility of the ground level being reduced by 100mm.
Haunch cables or ducts in bedding material to a minimum depth of 75mm above highest cable or duct. Install PVC marker tapes to all trenches as detailed below.
Minimum cover in cable trenches

HV cables 800mm (900mm depth).
LV cables 500mm (600mm depth).
Communications cables 500mm.
All cables 900mm minimum cover under roadways.

Mark each change of direction of cables with pre-cast concrete 300x300x150 thick impressed with LV or HV CABLE, laid level with finished ground level.

Installation to be in accordance with latest revision of NJUG Guides:
Utilities Guidelines on Positioning and Colour Coding of Apparatus (Vol 1)
Guidelines for the Planning, Installation and Maintenance of Utility Services in Proximity to Trees. (Vol 4)

320.025a PIPEWORK TRENCHES ETC:
Minimum cover in pipework trenches

Water 750mm minimum (900 -1200mm maximum where practical)
Gas 600mm (footway), 750mm (verge), 900mm (carriageway).
Fuel oil 900mm

To latest revision of NJUG Guides:

Utilities Guidelines on Positioning and Colour Coding of Apparatus
Guidelines for the Planning, Installation and Maintenance of Utility Services in Proximity to Trees

Install PVC marker tapes to all trenches as detailed below.
All services to be 900mm under roadways.

320.030 BACKFILLING GENERALLY:
Laid and well compacted in layers not exceeding 300 mm thick. Do not use heavy compactors before there is 600 mm depth of backfill.

320.040 BACKFILLING UNDER ROADS:
Laid and compacted in 150 mm layers.

320.051 TEMPORARY BRIDGES:
Provide temporary bridges over trenches as necessary to prevent construction traffic damaging services after backfilling.

320.061 IDENTIFICATION TAPES:
During backfilling lay continuous colour coded, heavy gauge polythene identification tapes, below surface along the route of each service. Warning tapes to be to BS EN 12613

WIDTH	up to 600mm	600-1000mm	1000-1400mm	1400-1800mm
DEPTH up to 500mm	1 tape at 200mm below ground level in the centre of the trench	2 tapes at 200mm below ground level horizontally spaced 400mm apart	3 tapes at 200mm below ground level each tape horizontally spaced 400mm apart	4 tapes at 200mm below ground level each tape horizontally spaced 400mm apart
DEPTH 500-800mm	1 tape at 200mm and 1 tape at 500mm below ground level in the centre of the trench	2 tapes at 200mm and 2 tapes at 500mm below ground level each tape on each level horizontally spaced 400mm apart	3 tapes at 200mm and 3 tapes at 500mm below ground level each tape on each level horizontally spaced 400mm apart	4 tapes at 200mm and 4 tapes at 500mm below ground level each tape on each level horizontally spaced 400mm apart

320.070 ACCESS/INSPECTION CHAMBERS CONSTRUCTION:
As indicated on the drawings.
Step irons : Bed in joints to all chambers over 900 mm deep at 300 mm vertical centres staggered 300 mm horizontally, with the lowest step iron 300 mm above the base and the top step iron 450 mm below the top of the cover.
Precast slabs : Bed solid in 1:3 cement: sand mortar.

320.080 ACCESS COVER & FRAME INSTALLATION:
Bed frame solidly in 1:3 cement: sand mortar over its whole area, centrally over opening, level with surrounding finishes and square with joints in surrounding finishes or with building. Where frame is in soil or grassed areas, haunch back edge of bedding so that it is not visible.

320.090 TEMPORARY DRAWPIT CONSTRUCTION:
Fill pit with clean dry sand on completion of services installation.

10000 Based on NES P30 / S16 TEXT Dec 19

R10 – Rainwater Pipework / Gutters

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide a piped internal/external rainwater disposal system taking surface water from roofs, balconies, canopies etc and connect to the first underground drain connection or gulley.

100.020 DESIGN PARAMETERS / GENERAL REQUIREMENTS
In accordance with relevant parts of BS EN 12056, current Building Regulations Technical Guidance documents and the requirements of the Local Authority. See Schedule of Common Design Criteria in A13 for rainfall intensity.

Fire sleeves shall be installed on all PVC/Polypropylene pipework 50mm diameter and above, passing through fire break walls, floors and ceilings and subject to approval by the Local Building Control Authority. To be tested to BS EN 1366-3.

Drainage pipes that are encased in a facade or cladding system shall be constructed from non-combustible material. Unless detailed otherwise elsewhere pipework to be stainless steel to relevant parts of BS EN 1124. Pipework to be designed by the specialist to accommodate thermal expansion.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO R10

300.000 PRODUCTS/MATERIALS

300.005 DRAINAGE SPECIALIST:
On design and build projects engage a drainage specialist to develop the design, install, commission and set to work a roof drainage system operating under gravity inside the building in accordance with BS EN 12056-3.

300.010 GALVANIZED STEEL PREFABRICATED STACK UNITS:
Standard BS 3868.

300.012 CAST IRON STACKS
Standard BS EN 877 - for pipes, fittings and accessories.

300.014 UPVC STACKS
Standard BS 4514 for DN 82 110 and 160 – for pipes, fittings and accessories.

300.016 UPVC STACKS
Standard BS EN 12200-1 for DN 65 – for pipes, fitting and the system.

300.018 CAST ALUMINIUM STACKS
Standard BS 8530 for Victorian ogee and moulded ogee aluminium rainwater systems.

300.020 CAST IRON GUTTERS AND FITTINGS:
Standard BS 460.
Profile as scheduled
Colour- self
Method of jointing
Use jointing material and bolt together.
Method of fixing
Fix in accordance with manufacturer's recommendations using:
fascia type galvanized mild steel or cast iron brackets with mushroom head galvanized screws to fascia, or rafter type galvanized mild steel or cast iron brackets with mushroom head galvanized screws to rafter, as required.

300.030 SHEET METAL GUTTERS AND FITTINGS
Standard - BS EN 612
Material - as scheduled
Profile – as scheduled
Gauge

Material nominal thickness and tolerances as BS EN 612
Colour – as scheduled
Method of fixing

Brackets to BS EN 1462 of material, size and profile to match guttering, fixed at 600 mm centres, via pre-drilled mounting holes (min diam 5mm)
Method of jointing-in accordance with manufacturer's recommendations.

300.040 UNPLASTICISED POLYVINYL CHLORIDE GUTTERS AND PIPING SYSTEM
Standard - BS EN 607
Piping system

External above ground - PVC-U to BS EN 12200-1

Colour – as scheduled
Method of jointing
Joint in accordance with manufacturer's recommendations.
Method of fixing

Brackets to BS EN 1462 size and profile to match guttering.
Fix at not more than 900mm centres via pre-drilled mounting holes (min dia 5mm).

300.150 THIMBLES AND SLEEVES:
Provide thimbles and sleeves of copper alloy, for use with lead.

300.160 COVER PLATES:
Application

For installation in building elements, by others, to provide access to concealed items or for Cleanout Access.
Details – as scheduled

300.180 ELASTOMERIC JOINTING GASKETS:
Standard
BS EN 681-2
Lubricant
Supply lubricant for pipework and guttering jointed with elastomeric joint rings.

300.191 THERMAL MOVEMENT JOINTS:
Provide thermal movement joints in accordance with the pipeline/guttering manufacturers recommendations.

300.201 FIXINGS FOR RAINWATER PIPES
For vertical fixing of cast iron rainwater pipes to walls and structure, use holderbats for fixing cast iron pipes.

310.000 WORKMANSHIP

310.010 INSTALLATION GENERALLY:
Install in accordance with BS 8000-0, BS 8000-13, BS EN 12056-5 (systems inside buildings) and manufacturer's recommendations to ensure complete discharge of rainwater from building without leaking.
Install thermoplastic piping systems in accordance with PD CEN/TR 13801.
Handle, store and securely fix all products and accessories in accordance with manufacturer's recommendations.
Obtain all components for each type of pipework and guttering from same manufacturer, unless otherwise indicated.
Inspect components before fixing and reject any which are defective. Ensure cut ends are clean and square with burrs removed.
Where not indicated otherwise use plated, sherardized, galvanized or non-ferrous fastenings, suitable for purpose and background, and compatible with material being fixed.
Allow for thermal and building movement when fixing and jointing.
Allow for thermal insulation when rainwater pipes run in ceiling voids.

310.020 BEFORE COMMENCING WORK
Ensure that below ground drainage is ready to receive rainwater or that the discharge can be dispersed by approved means to prevent damage or disfigurement of the building fabric.
Ensure any specific painting of surfaces which will be concealed or otherwise inaccessible, is completed.

310.025 TESTING

Inform CA in advance to give a reasonable opportunity to observe tests.
Check all sections of installation are free from obstruction and debris before testing.
Provide assistance and apparatus for testing.
Carry out an air test or water test in accordance with BS EN 12056-5
Remedy all defects without delay and re-test as instructed.

310.030 GUTTERS:
Set out to a true line and even gradient to ensure no ponding or backfall. Position high points of gutters as close as practical to roof and low points not more than 50mm below roof.
Position outlets to align with connections to below ground drainage, unless otherwise indicated on drawings.
Overlap joints in direction of fall and seal as specified to make watertight.
Ensure that roofing underlay is dressed into gutter.

310.040 GUTTER BRACKETS:
Fix securely at specified centres and at all joints in gutters, with additional brackets near angles and outlets.

310.050 SEALING JOINTS IN GUTTERS:
Spread jointing compound evenly over surface of socket.
Tighten fixings to squeeze out some compound, but do not over-compress. Remove surplus squeezed out compound and neatly clean off.

310.060 RAINWATER HEADS AND OUTLET PIPES FROM GUTTERS:
Fix suitable domical cages.

310.070 CONNECTION TO EXISTING GUTTERS:
Provide and fix all necessary and proper fittings for the purpose of connecting to existing gutters. Make good and leave the work in a watertight condition.

310.080 GUTTER TEST:
Block all outlets, fill gutters to overflow level and closely inspect for leakage.

310.090 STORAGE: PIPES, GUTTERS AND FITTINGS
Store pipes, gutters and fittings under cover and clear of the ground.

310.100 STACKING PIPES AND GUTTERS
Stack pipes and gutters on level surface. Do not rest pipes on their sockets. Securely stake end pipes in bottom row to prevent collapse of stack. Comply with manufacturer's recommendations.

310.110 STORAGE ELASTOMERIC JOINTING RINGS
Store elastomeric jointing rings/gaskets in their delivery bags or protective containers. Do not expose to sunlight.

310.120 MAKING GOOD
Make good damage to coatings or recoat.

310.130 ACCESS POINTS:
Provide rodding and access points at all changes of direction to enable whole system to be maintained, and at every other floor (minimum) on vertical pipework.
Provide square door type access points as indicated on drawings at foot of all rainwater stacks.
Fit covers, caps, etc. as work proceeds to prevent ingress of dirt and building materials.

310.140 RAINWATER OUTLETS:
Fix a grating or cage to restrict entry of solids to system.

310.150 ROOF AND BALCONY OUTLETS:
Ensure that outlets are securely fixed before connecting pipework.
Ensure junctions between outlets and pipework can accommodate all movement in roof decking and pipework.

310.181 CONNECTIONS BETWEEN PIPES OF DIFFERENT MATERIALS:

R10 – Rainwater Pipework / Gutters

PLASTIC
Connect plastics pipework to pipework of other materials using approved connectors and methods in accordance with plastics pipework manufacturer's recommendations, to form a watertight joint.

CAST IRON
Connect cast iron pipework to clay/concrete sockets with bitumenized yarn and 1:3 cement: sand mortar, neatly finished, to form a watertight joint.
Connect cast iron pipework to clay pipework using super sleeve adapters.

COPPER
Connect copper pipework to cast iron/clay using copper to cast iron/clay adaptors.

GALVANIZED STEEL
Connect galvanised steel pipework to clay/cast iron with a purpose made galvanised steel to clay/cast iron transition piece (to be provided by the rainwater pipe manufacturer) to suit the clay/cast iron adaptor.

10000 Based on NES R10TEXT Dec 19

R11 – Foul Drainage Above Ground

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide a piped gravity system to collect foul water from normal toilets, sinks and kitchen appliances and connect to the first underground drain connection.

100.020 DESIGN PARAMETERS
In accordance with BS EN 12056-2, BS EN 752, CIBSE Guide G: Public Health Engineering, current Building Regulations and requirements of the Local Authority.

100.022 BREEAM REQUIREMENTS:
On applicable projects and detailed elsewhere, comply with BREEAM requirements below to suit the type of construction and scheme.
BREEAM New Construction 2014 requirement
Comply with Issue ID Pol 03 Surface Water Run-off
Comply with Issue ID Wst 05 Adaptation to Climate Change
BREEAM New Construction 2018 requirement
Comply with Issue ID Pol 03 Flood and Surface Water Management
Comply with Issue ID Wst 05 Adaptation to Climate Change
BREEAM Refurbishment and Fit-out 2014 requirement
Comply with Issue ID Pol 03 Surface Water Run-off
Comply with Issue ID Wst 05 Adaptation to Climate Change

100.030 GENERAL REQUIREMENTS
Refer also to Scope of Works.
The system has generally been designed on the one pipe system, using foul waste and vent stacks which take the foul water discharge from the toilet areas, shower areas and cleaners sink etc. When a ventilation pipe is not viable an Air Admittance Valve (AVV) was used.

Anti-siphonage and ventilating pipes (and or anti-siphon traps) protect the traps on the appliances from loss of water/seal.

All soil waste and ventilating pipes shall have minimum falls as defined in BS EN 12056-2, or as shown on the drawings. Anti-siphonage pipework and ventilating pipes must be installed in such a manner as not to create a trap.

Access shall be provided at all changes of direction and above the connection point to the below ground drainage as shown on the drawings.

Main soil/waste ventilation pipes shall rise to roof level and terminate with a vent cowl for discharge to atmosphere.

Where plastic pipework passes through fire compartment floors and walls intumescent fire sleeves tested to BS 476 or BS EN 1366-3 shall be fitted.

Drainage pipes that are encased in a facade or cladding system shall be constructed from non-combustible material. Unless detailed otherwise elsewhere pipework to be stainless steel to relevant parts of BS EN 1124. Pipework to be designed to accommodate thermal expansion.

Thermal expansion shall be included on PVC and polypropylene soil waste and vent pipework.
Where pipes penetrate a floor separating habitable rooms in different flats within residential buildings they shall be enclosed for their full height and full horizontal run in each flat and surrounded with sound absorbent material above and below the floor. The installation shall comply with the requirements of Approved Document E of the Building regulations. “Resistance to the passage of sound”.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO R11

300.000 PRODUCTS/MATERIALS

300.005 DRAINAGE SPECIALIST:

R11 – Foul Drainage Above Ground

On design and build projects engage a drainage specialist to develop the design, install, commission and set to work a gravity drainage system inside the building in accordance with BS EN 12056 as appropriate.

300.011 SOIL WASTE AND VENT PIPEWORK

Refer to Schedule of pipelines Y10 for project particular requirements

Materials standards

Cast iron- BS EN 877
Welded stainless steel with spigot and socket – Relevant parts of BS EN 1124
PVC-U – BS EN 1329-1 / BS 4514
HDPE – Fusion welded BS1519-1

300.014 THERMAL EXPANSION ON ALL PVC/POLYPROPYLENE PIPEWORK

Provide expansion joints, thermal movement limiters, anchor points and support/brackets to allow for the correct thermal movement as recommended in the manufacturers installation guide. Alternative forms of thermal expansion arrangements will not be allowed without the prior approval of the CA.

300.015 METAL BANDED FLEXIBLE COUPLINGS ADAPTORS AND BUSHES:

Type as scheduled or described in the particular specification.
Flexible coupling without shear band.
Flexible coupling with shear band.
Flexible adaptor for use with pipes of different outside diameter.
Application
- Repair of damaged pipes
- Connecting pipes of different materials
- Connecting pipes of different diameter
- Jointing short / cut lengths of pipe
- Jointing post-inserted performed junctions

Standard - BS EN 16397-1 and BS EN 16397-2
Materials
- Sleeve - rubber to BS EN 681-1
- Clamping bands 304 stainless steel or 316 stainless steel.

300.016 FIRE SLEEVES

Fire sleeves shall be installed on all PVC/Polypropylene pipework 50mm diameter and above, passing through fire break walls, floors and ceilings and subject to approval by the Local Building Control Authority. To be tested to BS EN 1366-3.

300.017 HORIZONTAL BRANCH CONNECTIONS

All 75mm and 100mm branch connections shall connect to the main horizontal runs via a 135 degree branch and a 135 degree bend.

Where possible all smaller branch connections shall connect to the 75mm and 100mm horizontal runs at an angle of 45 degree above the centre line via a 135 degree bend.

300.018 VENT PIPE TERMINALS

All soil waste and vent stacks and waste and vent stacks shall, unless otherwise stated, shall rise through the roof finish with a weathering slate weathering collar and terminate 450 mm above the roof finish (flat or pitched) with a vent cowl. When not possible, an Air Admitance Valve can be used as long as located minimum 200mm above highest spillage level connection to drainage stack and is accessible for maintenance.

300.020 FLOOR GULLIES

Standard

Trapped with water seal of at least 50mm - BS EN 1253-1

Without trap - BS EN 1253-2

Gully with light liquid closure to avoid uncontrolled discharge of light liquids such as petrol, diesel and fuel oil into drainage systems in case of emergency to BS EN 1253-5

Material – parking areas, bike stores, bin stores to cast iron

Access covers to BS EN 1253-4

Class of gully / cover – as scheduled.

300.040 FALLS ON SOIL/WASTE PIPEWORK AND VENT PIPEWORK

Unless otherwise stated all 75mm and 100mm dia soil and waste pipework shall be installed to a fall of 1:60 all smaller dia. Waste pipework shall be installed to a fall of 1:50.

All vent and anti-siphon vent pipework shall be installed to a fall of between 1:80 and 1:100.

300.045 WASTE PIPEWORK DIAMETERS (UNLESS OTHERWISE STATED)

Wash hand basin	32mm
Sinks (general)	40mm
Cleaners Sinks	40mm
Shower Tray	40mm
Bath	40mm
WC Pans	100mm

300.050 SOIL AND WASTE STACKS TAKING THE DISCHARGE FROM PLANTROOM FLOOR GULLIES

Unless otherwise stated soil waste and vent stacks which take the discharge from plantroom floor gullies shall be installed in cast iron and not PVC.

300.130 PLASTICS WC PAN CONNECTOR

Combined solvent weld/pan seal socket connector for horizontal outlet WC pans to BS EN 33 or BS EN 997
For horizontal outlet and shrouded pans
BS 5627 for pans to BS EN33 'S' (turned 'P' traps, or 'P' traps new installations, or 'P' traps replacements) or BS EN 997 for WC pans and WC suites with integral trap.

300.140 GRATINGS:

Application

Vent pipe termination guards

Material

Galvanised steel wire, plastic coated, PVC or copper.

300.150 SINGLE STACK PLUMBING:

Ensure that there is a change of gradient at stack connections. Use swept branches on small diameter pipes. Use swept inlet or 45 degree branch connections for pipe 75 mm dia or over.

310.000 WORKMANSHIP

310.005 FOOT OF PIPE STACKS:

Fix cast iron rest bends supported on brick-work or concrete bases where indicated on drawings.

310.010 PERFORMANCE CRITERIA:

Install pipework fittings and accessories to ensure that:

- appliances drain quickly, quietly and completely at all times without nuisance or risk to health.

- discharge is conveyed without crossflow, backfall, leakage or blockage.
- air from drainage system does not enter building.
- pressure fluctuations in pipework do not vary by more than plus or minus 38mm water gauge and traps retain a water seal of not less than 25mm.
- system can be adequately tested, cleaned and maintained.

310.020 PIPE ROUTES:
Ensure pipe routes are shortest practicable, with as few bends as possible and no bends in wet portion of soil stacks, unless indicated otherwise on drawings.

310.030 COATED PIPES:
Make good damaged coatings and cut ends, or recoat, as recommended by manufacturer.

310.041 INSTALLATION GENERALLY:
Install pipes, fittings and accessories in accordance with BS 8000-0, BS 8000-13, BS EN 12056-2 and manufacturer's recommendations.
Install thermoplastic piping systems in accordance with PD CEN/TR 13801.
Obtain all components for each type of pipework from the same manufacturer, unless otherwise indicated.
Inspect components carefully before fixing and reject any which are defective.
Ensure cut ends of pipes to be clean and square with burrs removed.
Allow for thermal and building movement when jointing and fixing in accordance with tile manufacturers recommendations.

Form junctions using fittings intended for the purpose, ensuring that jointing material does not project into bore of pipes, fittings and appliances.
Avoid contact between dissimilar metals and other materials which would result in electrolytic corrosion.
Provide access covers and cleaning eyes as necessary in convenient locations, to permit adequate testing and cleaning of pipework.
Prevent entry of foreign matter into any part of system by sealing openings during construction. Fit all access covers and cleaning eyes as work proceeds.

310.050 CONNECTIONS BETWEEN PIPES OF DIFFERENT MATERIALS:

PLASTICS
Connect to pipework of other materials using approved connectors and methods in accordance with plastics pipework manufacturer's recommendations, to form a watertight joint.

CAST IRON
Where possible, connect cast iron pipework to clay pipework using super sleeve adapters.

COPPER
Connect copper pipework to clay/cast iron using copper to cast iron/clay adaptors whenever possible.

GALVANIZED STEEL
Connect galvanized steel pipework to cast iron sockets with bitumenized yarn and molten lead, lead wool or an approved cold caulking compound.

Connect galvanized steel pipework to clay/concrete sockets. A purpose made galvanised steel to clay/cast iron transition piece (to be provided by the rainwater pipe manufacturer) to suit the clay/cast iron adaptor.

310.070 WASTES:
Bed in waterproof jointing compound and fix with resilient washer between appliance and backnut.

310.080 WASTE CONNECTORS:
Join to traps as manufacturer's recommendations.

310.091 WC PANS:
Connect to soil pipe spigots with plastic connectors in accordance with connector manufacturer's recommendations.

310.100 TRAP TEST REQUIREMENTS:

R11 – Foul Drainage Above Ground

Ensure there is a retention of 25mm water seal in every trap, and that no air is blown through the trap seal when performance is tested.

310.110 ACCESS POINTS:
Provide rodding and access points at all changes of direction to enable whole system to be maintained.
Provide square door type access points as indicated on drawings at foot of all soil waste and ventilation pipes and at low level above each floor level. Where practicable, locate access points and horizontal anti-siphon pipes above fitment flood level.
In general make WC connections to drain points and soil pipes via flexible connectors.

10000 Based on NES R11TEXT – Dec 19

S10 – Cold Water

Incorporating S13 (pressurised water) and S16 (Borehole water / well water)

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES

To provide a piped water supply system to bring water from the supply authority's main and distribute it to a variety of user points.

To provide water storage and a piped water supply system distributing cold water services to a variety of user points using gravity and/or pressure boosters as indicated on the drawings and schedules.

Where a borehole is required, engage a borehole and well specialist to develop, design, supply, install (including all civil works), commission and set to work the borehole/well pumping system.

100.020 DESIGN PARAMETERS

For installations inside buildings In accordance with relevant parts of BS EN 806 and supplementary guidance in BS 8558, CIBSE Public Health Engineering Guide G, CIBSE TM13, HSE Approved Code of Practice & Guidance L8 and associated guidance in HSG 274 Part 2 (The Control of Legionella Bacteria in Water Systems).

For water supply systems outside buildings comply with the requirements of BS EN 805.

Comply with the requirements of:

England and Wales - The Water Supply (Water Fittings) Regulations 1999, as amended, the Water Act 2014 and The Construction Products Regulations 2013.

Scotland - The Water Supply (Water Fittings) Byelaws 2014.

Northern Ireland - The Water Supply (Water Fittings) Regulations (Northern Ireland) 2009.

Comply with appropriate WRAS guidance.

Comply with WRAS guidance on prevention of contamination and waste of drinking water supplies.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO S10

300.000 PRODUCTS/MATERIALS

Refer to scope of works and schedules in addition to the clauses below.

The contractor shall provide comprehensive data sheets for all water services components to validate specification compliance and for approval, this shall include a valid WRAS (or equal and approved) approval number with expiry date.

In addition to the particular valve type standard, valves to be used in, or connected to, water supply pipe systems, above or below ground carrying water intended for human consumption to comply with the relevant parts of BS EN 1074 and BS 5163 as appropriate to the application.

300.001 PRESSURE EQUIPMENT DIRECTIVE/PRESSURE EQUIPMENT REGULATIONS:

All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 2014/68/EU, implemented in the UK through the Pressure Equipment (Amendment) Regulations 2015 and The Pressure Equipment (Safety) Regulations 2016, must be tested by the manufacturers, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.

Only relevant equipment and assemblies certified as compliant will be permitted under this specification, and any substitution put forward must also be compliant with the Directive.

300.005 APPROVALS:

Ensure all water fittings and materials are listed in the Water Fittings and Materials Directory published by WRAS.

Water regulations – Notification of works and Inspections:

The contractor shall notify the local water authority of any notifiable water services installation in accordance with regulation 5 and 6, and arrange for a water authority inspection and approval of installation before handover of the building in accordance with Water Supply (water fittings) Regulations 1999 as amended.

300.008 BREEAM REQUIREMENTS (NEW BUILD):

All water systems must be designed in compliance with HSE L8 Legionnaires' disease. "The control of legionella bacteria in water systems. ACOP and guidance (fourth edition, 2013)". Details may comply with CIBSE TM13 Minimising the Risk of Legionnaires' Disease, in demonstrating that the design meets the criteria of HSE ACOP.

Humidification systems to be failsafe.

On applicable projects and detailed elsewhere, comply with BREEAM requirements below to suit the type of construction and scheme.

BREEAM New Construction 2014 requirements
Comply with Issue ID Wat 01 Water Consumption.
BREEAM New Construction 2018 requirements
Comply with Issue ID Wat 01 Water Consumption.

300.011 WATER METERS

Install a water meter to the incoming mains supply and / or sub meters within the building as scheduled or described in the scope of works. Install in line strainer upstream of each water meter. Locate the meters to allow for easy access for meter reading by the building's occupants.
Meters and the installation to comply with The Measuring Instruments Regulations 2016
Standards – comply with relevant parts of BS EN ISO 4064
Provide full flow accumulative type water meter with dial indicator to record quantity of water passed. Enclose mechanism of each meter within a cast iron body with a helical vane mounted centrally in the
body of the meter. Supply an interchangeable pattern mechanism. Incorporate, as an integral part of each meter, a water guide at inlet to direct water evenly on to helical vane. Provide each meter with zeroing device.
Mechanical/electrical meters or meters with a digital indicating device and other types of electronic or magnetic meter, to be complete with all necessary components and facilities. These shall include transducer, sensor, adjustment and correction facilities, indicating device to display volume continuously or periodically on demand and facilities for interface with a BMS.
Ancillary (additional functionality) devices for Smart Metering to comply with BS EN 14154-4 - refer to schedules for details.
Provide isolating valves on either side of each meter assembly (bypasses on potable water systems should be avoided due to the risk of water stagnation/legionella).
Provide flanged connections to BS EN 1092-1, BS EN 1092-2 or BS EN 1092-4 on each meter. Where meters are of smaller bore than connecting pipework, install flanged reducers.
Provide facility for remote monitoring of peak flow and total water consumption by BMS.
Where a BREEAM credit is required for water meters comply with relevant BREEAM issue ID and ensure all meters shall have pulsed output and are connected to the BMS and ensure meters are installed on large water consuming plant equal to or greater than 10% of the total water demand of the building. Comply with BREEAM 2014 Issue ID Wat 02 or BREEAM New Construction 2018 Wat 02 Water Monitoring.

300.061 PACKAGED WATER BOOSTER SETS

The units are to be WRC approved.
Supply a fully automatic, works tested packaged unit on common base plate or skid complete with flexible connections and AV mountings.
To be complete with hydraulic accumulator / expansion vessel to BS EN 13831, filled with nitrogen and sized to limit the pump starts to a maximum of 10 starts per hour. Unless scheduled otherwise accumulator to be "flowjet" type flow-through and include shut-off and discharge valve.
Diaphragm material to be WRAS approved in accordance with relevant parts of BS 6920.

Booster set to be complete with multiple pumps, pre-wired control panel and interconnecting pipework. Refer to schedule for pump / pressure control method, alarms and BMS interfaces.
Provide control module to provide surge protection on start-up or when power is restored by allowing only one pump to be enabled and pulsed for a pre-set time until a pre-set pressure is reached.

Duty, controls and general components to be as scheduled.

300.061a BOOSTER SET CONTROL PANEL

Enclosure Fabricate from mild steel sheet 1.6mm thickness minimum,
Finish Manufacturer's standard
Components and further details as scheduled
Refer to clause W60 320.101 for control panel design and construction.

300.065 PHYSICAL WATER CONDITIONERS:

Refer to schedule S10sch2

300.067 WATER DISINFECTION PLANT AND DOSING:

The design of the system and controls shall ensure Drinking Water Inspectorate (DWI) limit of 0.5mg/l for total chlorate / chlorine compounds is not exceeded.
Comply with HSE L8 / HSG 274 Part 2

System details
In line reaction chamber with a valved by-pass around the reaction chamber.
Pumps and electronics to be located in separate compartments
Standards and Regulations
BS EN 12671
HSE L8 / HSG 274 Part 2
Control of Substances Hazardous to Health Regulations
HTM 04-01 Part A where applicable
Installation, testing and commissioning – to be in accordance with the manufacturer's recommendations

300.068 SAFETY OF EQUIPMENT: [S16 300.060]
Ensure all data communications equipment is designed, installed and commissioned in accordance with,
BS EN 60950-1
BS EN 62368-1

300.070 ELECTROMAGNETIC COMPATIBILITY: [S16 300.070]
Ensure all equipment complies with the Electromagnetic Compatibility Regulations 2016.
Ensure all equipment carries the CE Mark, and is suitable for the electromagnetic environment in which it is to be used, for the service to which it is to be put.
Ensure that all control and monitoring system cabling is selected and installed to comply with the EMC requirements of BS 7671 (IET Wiring Regulations) and BS EN 50174-series.

310.000 WORKMANSHIP
Comply with the requirements of BS EN 8000-0 and BS 8000-15 where applicable on domestic scale projects.

310.005INSTALLATION GENERALLY
Install, test and commission systems to comply with BS EN 806-4 and complimentary guidance in BS 8558, Water Supply (Water Fittings) Regulations 1999 or bylaws and equipment manufacturer's recommendations.
England and Wales - The Water Supply (Water Fittings) Regulations 1999, as amended by The Water Supply (Water Fittings)(Amendment) Regulations 1999, The Water Act 2003 (Consequential and Supplementary Provisions) Regulations 2005 and The Construction Products Regulations 2013.
Scotland - The Water Supply (Water Fittings) Byelaws 2014.
Northern Ireland - The Water Supply (Water Fittings) Regulations (Northern Ireland) 2009.

Flushing and disinfection of services suppling water for domestic use to be carried out in accordance with BS EN 806-4 and following the guidance in BS EN 8558 and PD 855468. Refer to the pipework cleaning and chemical treatment section of this specification for details.
Construct the system to ensure it is safe and without risks to health and where applicable incorporate in the final design/installation recommendations given in HSG274 Part 2.
Locate sampling points following the guidance and recommendations in the Code of Practice for the sampling and monitoring of hot and cold water services BS 8554 and document these in a sampling plan prepared in accordance with BS EN ISO 5667-1.
Undertake sampling following construction completion in accordance with the guidance and recommendations in BS 8554.
Undertake microbiological tests on samples and provide the results as part of the handover documentation to demonstrate that the systems are clear of organisms of concern. Preserve and handle samples in accordance with BS EN ISO 5667-3.
Install thermoplastics pipework in accordance with BS 5955-8.

310.010 CONNECTIONS TO TAPS AND APPLIANCES AND EQUIPMENT
Make final connections to taps and appliances including the incorporation of a flow regulator within the fitting isolation valve where the static pressure exceeds 1 bar.
For electrical appliances connected to water mains, comply with the manufacturer's recommendations and requirements of BS EN 61770 as below:
To prevent the backsiphonage of non-potable water into the water mains
Flexible hose assemblies intended to be used as integral parts of appliances, to be in accordance with the standard
Flexible hose assemblies designed for connecting appliances to drinking water installations to be in accordance with BS EN 13618.

310.022 INSTALLATION OF WATER METERS:
Install water meters in accordance with manufacturer's instructions and BS EN ISO 4064-5
Comply with the requirements of BS EN 14154-4 for additional functionality devices associated with Smart Metering.

310.030 INSTALLATION OF PRESSURE BOOSTER SETS
Install pressure booster sets in accordance with manufacturer's recommendations
On healthcare projects comply with HTM 04-01 Part A.

310.032 INSTALLATION OF WATER DISINFECTION DOSING PLANT
Install and commission dosing plant in accordance with manufacturer's recommendations
Refer to schedule S10sch5 for duty / specific requirements.

310.033 INSTALLATION OF WATER CONDITIONERS
Install and commission Water Conditioners in accordance with manufacturer's recommendations
Refer to schedule S10sch2 for type duty / specific requirements.

310.051 ISOLATION
Install isolation valves at the following locations as a minimum standard.

At all terminal units

At all sanitary fittings.

At all main branch connections and at high level in feeds which drop to low level to water outlets in benches etc.

Where piped services feed a zone or floor from risers

All quick fill points and bib taps shall comply with the Water Supply (Water Fittings) Regulations1999 including where connected into a sub circuit of an existing building.

310.060 GROUND INVESTIGATIONS: [S16 300.025]
Where required for below ground works – refer to scope of works / drawings for details.
Standard - Undertake ground investigations and testing to Eurocode 7 (BS EN 1997 Parts 1and 2) and UK National Annex to Eurocode 7 and the guidance in Code of Practice for ground investigations - BS 5930.
Properties to be established
- Grading.
- Bearing capacity.
- Permeability.
- Water table.
- Liquefaction.
- Settlement.
- Subsidence.
- Buried services.
- Rock outcrops.

310.070 EXCAVATION
Excavate in a clean and organised manner. Schedule with other site activities to provide controlled access and minimal tracking of soil over the site.

Set out and use sight boards to ensure uniform falls.
Separate top soil and set aside for later use.
Evacuate trench width to a minimum of 300mm above the top of the pipe barrel within indicated limits. Keep available materials for adequate shoring when excavation depth over 1.2m is intended.
Where rock is encountered in trench bottoms designed as Class D bedding further excavate to the depth necessary to receive Class F.
Backfill over-excavation, whether intentional at soft spots or accidental with rubble.
Spoil, which is either in excess of or does not fulfil the requirements for selected fill.
- Place in spoil heaps, or take off site as directed.

310.052 [S16] PIPE LAYING:
Use slings that do not damage either pipe or coating. Thoroughly inspect pipes prior to slinging.
Do not lower pipes until the trench bottom has been approved to receive the pipes. Ensure pipes are in correct alignment and orientation, concentric with the pipes already laid.

Make joints in accordance with manufacturer's instructions using the proprietary materials indicated.
Use a purpose made adapter for joints between pipes of different materials. If none is available, abut the pipes, tape and seal the gap, surround by 1/2 sections or less for 1m either side of the joint and surround in C20 concrete 150mm thick for 2m either side of the joint.

310.060 [S16] STRUCTURES:
Ensure pipes in and out of structures are as short as possible. Surround by concrete at least 150mm thick. Set pipes sufficiently steep to prevent the possibility of differential settlement causing a backfall.

310.070A [S16] BEDDING, PROTECTION AND BACKFILL:
Make cavities in the bedding to facilitate sling removal. Elsewhere smooth the trench bottom. Prepare one full pipe length in advance of pipelaying.
Locate interfaces between backfilled materials to the weaker material side of theoretical.
Concrete is the strongest and selected fill the weakest. Lay all fill less than 300mm above the top of the pipe barrel in 150mm layers and hand compact. Above this level layers may be 225mm. Over 1m above top of pipe mechanical compaction may be used.

310.080 [S16] BACKFILLING OVER CONCRETE:
Do not start backfilling within 24 hours of placing concrete. Do not use heavy compactors and prevent imposition of traffic loads within 72 hours of placing concrete.

310.090 [S16] TEMPORARY BRIDGES:
Provide temporary bridges over trenches as necessary to prevent construction traffic damaging pipes after backfilling.

310.100 [S16] WARNING MARKER TAPES:
Lay during backfilling in a continuous line over pipelines, 300 to 400mm below the level of the finished surface.
Lay an additional marker 600mm above the top of the pipeline for pipes at a greater depth than 800mm.

320.050 LIFTING KEYS:
Provide lifting keys for each type of access cover and hand over to the Employer at Practical Completion.

320.060 [S16] WATER TESTING OF MANHOLES/INSPECTION CHAMBERS:
Before backfilling test each manhole or chamber in accordance with BS EN 752 and BS EN 1610 for Exfiltration and Infiltration.

340.000 WORKMANSHIP [S16]

340.010 [S16] PIPELINE ROUTES:
Ensure pipeline routes are as short as possible consistent with,
- natural topography and subsoil conditions.
- as far as possible increasing slopes downstream.
- avoidance of tree root growth areas.

340.020 [S16] MATERIALS IN THE WORKS:
Inspect all buried materials prior to installation. Make good damaged coatings and cut ends.
Reject where damage is more than superficial.

340.030 [S16] QUALITY CONTROL:
Check that all materials comply with the indicated standard before acceptance to store. Transport, handle and store in accordance with manufacturer's recommendations, to avoid damage or contamination.
Obtain all components for each type of pipework from the same manufacturer.
Ensure cut ends of pipes are clean, square and free of burrs.
Prepare trenches to receive pipes and allow for jointing, testing and removal of slings.
Install all components in accordance with the manufacturer's recommendations.
Joint according to manufacturer's recommendations and allow for movement, taking particular care next to buildings and manholes.
Prevent entry of foreign matter and clean prior to testing or putting to use.
Backfill and compact in layers to ensure adequate consolidation.

340.060 [S16] INSULATION:
Where control components are incorporated in insulated pipelines, ductlines or equipment, provide details for approval of method proposed to insulate component.

340.070 [S16] SUPPORTS:
Arrange supports for control components to ensure no strain is imposed on components.

340.080 [S16] ACCESS:
Arrange control components and enclosures to ensure adequate access for operation and maintenance

10000 Based on NES S10Text Dec 19, S13 Mar 16 and S16 Dec 18

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES

To provide a piped supply system generated, storing and distributing hot water to sanitary fittings, sinks and other appliances.

BREEAM

On applicable projects and detailed elsewhere, comply with BREEAM requirements below to suit the type of construction and scheme.

BREEAM New Construction 2018 requirement

Comply with Issue ID Ene 01 Reduction of Energy Use and Carbon Emissions

Comply with Issue ID Ene 04 Low Carbon Design

BREEAM Refurbishment and Fit-out 2014 requirement

Comply with Issue ID Ene 01 Reduction of Energy Use and Carbon Emissions

Comply with Issue ID Ene 04 Low Carbon Design

100.020 DESIGN PARAMETERS

In accordance with relevant parts of BS EN 806 and supplementary guidance in BS 8558, CIBSE Public Health Guide G, CIBSE TM 13, HSE Approved Code of Practice & Guidance L8 and associated guidance in HSG 274 Part 2 (The Control of Legionella Bacteria in Water Systems).

Comply with the requirements of:

England and Wales - The Water Supply (Water Fittings) Regulations 1999, as amended by The Water Supply (Water Fittings)(Amendment) Regulations 1999, The Water Act 2003 (Consequential and Supplementary Provisions) Regulations 2005 and The Construction Products Regulations 2013.

Scotland - The Water Supply (Water Fittings) Byelaws 2014.

Northern Ireland - The Water Supply (Water Fittings) Regulations (Northern Ireland) 2009.

If required in the scope of works, undertake calculation of design heat load and storage volume for domestic hot water in accordance with BS EN 12831-3.

Comply with appropriate WRAS guidance.

In addition to controls requirements detailed elsewhere in the specification, provide the minimum controls package for compliance with Part L as defined in the Non Domestic Building Services compliance guide

Unvented hot water storage systems to be complete with “unvented kits” and pressure regulating valve to comply with Building Regulations safety requirements within Approved Document G3. Indirectly heated storage water heaters shall comply with BS EN 12897.

See Schedule of Common Design Criteria.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO S11

300.000 PRODUCTS/MATERIALS

See scope of Works and Schedules in addition to clauses below.

The contractor shall provide comprehensive data sheets for all water services components to validate specification compliance and for approval, this shall include a valid WRAS (or equal and approved) approval number with expiry date.

Comply with EU Regulation 814/2013 with regard to eco-design requirements for water heaters with rated heat output of up to 400kW and hot water storage tanks with a storage volume of up to 2000 litres regarding limiting standing loss and product information.

Manufacturers to undertake energy assessment of domestic / sanitary hot water storage tanks of up to 2000 litres in accordance with BS EN 15332.

Manufacturers to comply with the test methods in BS EN 50440 to measure the performance of electric storage water heaters.

Gas fired domestic appliances producing hot water to be in accordance with relevant parts of BS EN 13203.

300.001 PRESSURE EQUIPMENT DIRECTIVE/PRESSURE EQUIPMENT REGULATIONS:
All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 2014/68/EU, implemented in the UK through the Pressure Equipment (Amendment) Regulations 2015 and The Pressure Equipment (Safety) Regulations 2016, must be tested by the manufacturers, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.

Only relevant equipment and assemblies certified as compliant will be permitted under this specification, and any substitution put forward must also be compliant with the Directive.

300.005 APPROVALS:
Ensure all water fittings and materials are listed in the Water Fittings and Materials Directory published by WRAS.

300.008 WATER METERS:
Type / duty / details / BMS interface - as scheduled or detailed in scope of works
Install sub water meters to the water supplies as detailed. Locate the meters to allow for easy access for meter reading by the building's occupants.
Standards - BS EN ISO 4064-1, BS EN ISO 4064-2, BS EN ISO 4064-3, BS EN ISO 4064-4
Meters for potable water to be WRc approved.
For mechanical analogue cumulative meters provide a dial indicator to record quantity of water passed. Enclose mechanism of each meter within a cast iron body. Incorporate, as an integral part of each meter, a water guide at inlet to direct water evenly on to the meter. Provide each meter with a zeroing device.
Mechanical/electrical meters or meters with a digital indicating device and other types of electronic or magnetic meter, to be complete with all necessary components and facilities. These shall include transducer, sensor, adjustment and correction facilities, indicating device to display volume continuously or periodically on demand and facilities for interface with a BMS.
Ancillary (additional functionality) devices complying with BS EN 14154-4 for Smart Metering.
Provide isolating valves on either side of each meter, and full-bore valved bypass installed around meter assembly.
Provide facility for remote monitoring through pulsed output.
Electrical supply - 24V DC.

300.030 STORAGE WATER HEATER(S):
Standards
- Gas fired storage water heater of nominal heat input not exceeding 150 kW (net CV) to BS EN 89.
  - For appliances up not exceeding 70kW and hot water storage capacity not exceeding 500l manufacturer to have undertaken an assessment of performance of hot water delivery to BS EN 13203-1
  - Assessment of energy consumption for units with heat input not exceeding 400kW and hot water storage capacity not exceeding 2000l to BS EN 13203-2.
  - Where the gas fired unit with heat input not exceeding 400kW and hot water storage capacity not exceeding 2000l is combined with an electrical heat pump, assessment of energy consumption to BS EN 13203-5.
- Safety of electric storage water heater to BS EN 60335-2-21.
- Safety of fixed electric immersion heater to BS EN 60335-2-73.
- Comply with the test methods in BS EN 50440 to measure the performance of electric storage water heaters.

- Oil fired combination boilers up to 70kW output to be in accordance with relevant parts of BS EN 303.

300.032 HEAT PUMP WATER HEATER(S):
Type – as scheduled
Standards
Safety and environmental - Relevant parts of BS EN 378
Classification, testing / operating requirements, marking and instructions
- Relevant parts of BS EN 14511
- BS EN 16147 for domestic hot water heat pumps.
- For heat pump combination heaters the seasonal efficiency of space heating is determined according to BS EN 14825.

Acoustic
- Determine sound power levels in accordance with BS EN 12102-2

300.050 THERMOSTATIC MIXING VALVES:
Valves to be WRAS approved. All non-metallic parts in contact with water shall meet WRAS requirements or comply with relevant parts of BS 6920.

Valves to be independently tested and approved to BuildCert scheme TMV3 unless detailed otherwise elsewhere in this specification.
Location - Where indicated or scheduled.
Standard/type
BS EN 1111 for high operating pressure (static up to 10bar and dynamic 1-5bar)
Type 1 - single control for regulating flow and temperature
Type 2 - dual control- separate control devices for regulating flow and temperature.
Type 3 - single sequential control with a single control operating through a predetermined sequence of flow and temperature.
BS EN 1287 for low operating pressure (Static up to 10bar and dynamic 0.2-1bar)
Type 1 - single control for regulating flow and temperature
Type 2 - dual control- separate control devices for regulating flow and temperature.
Type 3 - single sequential control with a single control operating through a predetermined sequence of flow and temperature.
For care establishments comply with BS 7942 (which complements BS EN 1111 and BS EN 1287 where a particular risk of scalding exists to the user) and HTM 04-01: Supplement – Performance specification D08 thermostatic mixing valves (healthcare premises).
Type A, both flow control and user adjustment of mixed water temperature.
Type B, flow control and pre-set mixed water temperature.
Type C, without flow control and with pre-set temperature.
Category 1 - with electronic temperature adjustment, mixed water temperature changed progressively.
Category 2 - with electronic temperature adjustment, mixed water temperature changed by predetermined step each time it is activated.
Material
Body - DZR brass.
Finish
Chrome plated

300.060 MECHANICAL MIXING VALVES:
Standard
BS EN 1286
Single control for adjusting flow rate and temperature.

300.080 EXPANSION VESSELS:
Standards
Supply WRAS approved expansion vessels for unvented hot water supply systems in accordance with the following standards.
BS 6144 for unvented hot water supply systems
BS EN 13831
Relevant parts of BS 6920.

310.000 WORKMANSHIP
Comply with the requirements of BS 8000-15 where applicable on domestic scale projects.

310.005 INSTALLATION AND COMMISSIONING GENERALLY
Install, test and commission systems to comply with equipment manufacturer's recommendations, BS EN 806-4 , complimentary guidance in BS 8558 and relevant Water Supply (Water Fittings) Regulations or Byelaws and equipment manufacturer's recommendations
England and Wales - The Water Supply (Water Fittings) Regulations 1999 as amended, the Water Act 2014 and The Construction Products Regulations 2013.
Scotland - The Water Supply (Water Fittings) Byelaws 2014.
Northern Ireland - The Water Supply (Water Fittings) Regulations 2009.

Flushing and disinfection of services supplying water for domestic use to be carried out in accordance with BS EN 806-4 and following the guidance in BS 8558 and PD 855468. Refer to the pipework cleaning and chemical treatment section of this specification for details.
Construct the system to ensure it is safe and without risks to health and where applicable incorporate in the final design/installation recommendations given in HSG274 Part 2.
Locate sampling points following the guidance and recommendations in the Code of Practice for the sampling and monitoring of hot and cold water services BS 8554 and document these in a sampling plan prepared in accordance with BS EN ISO 5667-1.
Undertake sampling following construction completion in accordance with the guidance and recommendations in BS 8554.

Undertake microbiological tests on samples and provide the results as part of the handover documentation to demonstrate that the systems are clear of organisms of concern. Preserve and handle samples in accordance with BS EN ISO 5667-3
Install thermoplastics pipework in accordance with BS 5955-8.
Undertake thermal balancing of HWS and CWS systems in accordance with Commissioning Specialist Association Technical Memorandum TM19.

310.020 CONNECTIONS TO TAPS AND APPLIANCES
Make final connections to taps and appliances including the incorporation of a flow regulator within the fitting isolation valve where the static pressure exceeds 1 bar.
For electrical appliances connected to water mains, comply with the manufacturer's recommendations and requirements of BS EN 61770 as below:

- To prevent the backsiphonage of non-potable water into the water mains
- Flexible hose assemblies intended to be used as integral parts of appliances, to be in accordance with the standard

Flexible hose assemblies designed for connecting appliances to drinking water installations to be in accordance with BS EN 13618.

310.030 WATER HEATER INSTALLATIONS
Comply with manufacturer’s instructions and recommendations for the installation of heater.
Locate heater with adequate surrounding space for service and maintenance.

310.040 INSTALLATION AND COMMISSIONING OF THERMOSTATIC MIXING VALVES:
Install and commission thermostatic mixing valves and mechanical mixing valves in accordance with manufacturer's recommendations.
On healthcare projects comply with HTM 04-01Part A and HTM 04-01 supplement: performance specification D 08 - thermostatic mixing valves (healthcare premises).
For TMV2 and TMV3 approved valves comply with the scheme's installation and maintenance documentation requirements.
For TMV3 approved valves comply with the scheme onsite testing requirements.

310.050 INSTALLATION OF WATER METERS:
Install water meters in accordance with manufacturer's instructions and BS EN ISO 4064-5
Comply with the requirements of BS EN 14154-4 for additional functionality devices associated with Smart Metering.

310.051 ISOLATION
Install isolation valves at the following locations as a minimum standard.

- At all terminal units
- At all sanitary fittings.
- At all main branch connections and at high level in feeds which drop to low level to water outlets in benches etc.
- Where piped services feed a zone or floor from risers

10000 Based on NES S11Text. Dec 19

S61 – Dry Risers

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide an empty vertical pipework distribution system with connections at ground level for the firefighting tender and at each level for firefighting hoses.

100.020 DESIGN PARAMETERS
To the requirements of BS 9990, BS 9999 and those of the local fire officer/local authority.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO S61

300.00 GENERAL

300.010 STANDARDS:
Comply with BS 9990 and BS 9999.
Refer to Y51 for specific testing and commissioning requirements

300.020 FIRE AUTHORITY REQUIREMENTS:
Ensure all system components are approved by local Fire Authority.

300.030 BONDING:
Incorporate provision for earth bonding in accordance with BS 7671 (IET Wiring Regulations).

300.050 INTEGRATION, CONTROL AND MONITORING:
Provide an integrated system as defined in the scope of works.
Ensure interfaces to fire detection and alarm system comply with the relevant parts of BS 5839 and BS 7273.
Ensure relevant equipment complies with BS EN 50130-4.

300.060 SOFTWARE:
Where relevant on particular projects obtain on behalf of the end users all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Provide documentation for application software in accordance with BS ISO/IEC 26513 and BS ISO/IEC 26514.
Ensure that, as far as practicable, all software is commercially available off-the-shelf.
Ensure that any programmable configuration, customisation, and bespoke software, is developed, tested and commissioned using relevant processes and procedures complying with BS ISO/IEC/IEEE 12207 or BS ISO/IEC/IEEE 15288 supported by a quality management system meeting the requirements of BS EN ISO 9001.

310.000 PRODUCTS/MATERIALS

310.011 INLET BREECHINGS:
Two way breeching.
Standard
BS 5041-3.
Components
Instantaneous inlet couplings to BS 336.
Protecting cap retained by a chain.
Inlet box
Standard
BS 5041-5, to suit breeching inlet.
Components
Wired glazed door with lock.
Finish
Powder painted finish. The designation on the glass panel of the inlet box shall read “Dry Riser Inlet” or “Dry Falling Main” as applicable.
Provide inlet box to builder for installation where scheduled.

310.021 LANDING VALVES:

Standard

BS 5041-2.

Connection

Flanged to BS EN 1092, PN to match system pressure.

Components

Instantaneous coupling to BS 336
Protecting cap with retaining chain.
Leather strap and padlock to secure valve in closed position.

Outlet boxes (where scheduled)

Install landing valves in purpose made outlet boxes.
Standard - BS 5041-4
Size - To match valve configuration
Wire glazed door with spring cylinder lock.

310.025 INTERMEDIATE RISER ISOLATION VALVES

Install isolating valves in each system at intervals not exceeding 10m so that sections of the fire main can be isolated. Secure each valve in the open position by a chain and paddock with matching keys. Valves to be monitored as detailed in the scope of works and work section W60

Standard Face to face dimensions comply with BS EN 593

Type Butterfly, LPC,FM or UL approved, lever or wheel head side geared operated as scheduled or described in the scope of works, suitable for 1½ times maximum working pressure of the system.

310.031 DRAIN VALVES

Standard - BS 5041-3.
Secure a notice in inlet box to locate system drain valves in accordance with BS 5041-5.

310.040 AIR RELEASE VALVE:

Install Air Release Valves in each system in accordance with BS 9990

320.000 WORKMANSHIP

320.005 AIR VENTING

Provide purpose designed automatic air release values (min. 25mm) at the top of each riser.
Material -Brass

320.010 INSTALLATION OF DRY RISERS:

Install and test dry risers in accordance with BS 9990.
Install, test and commission all fire protection systems to requirements of local Fire Authority.
Make changes in direction with bends or long radius fittings. Extend rising main progressively as building works proceed.

320.021 INSTALLATION OF INLET BOXES:

Install inlet boxes in position as scheduled.
Indication:

If, unusually the inlet is to be located in a pit or otherwise away from the face of the building, provide a notice on the face of the building indicating the distance of the inlet from the notice. Lettering to be a minimum of 100mm high.

320.040 QUALITY CONTROL:

Where relevant on particular projects record all commissioning tests and site modifications to hardware or software, and revise operating and maintenance instructions accordingly.
Manage configuration of software settings, data and design, in accordance with an appropriate Configuration Management Plan (CMP), complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC/IEEE 12207 and BS ISO/IEC/IEEE 15288.
Provide configuration details along with the operation and maintenance manual on hand-over.
Manage information security of systems, software and data during design, implementation and commissioning in line with BS EN ISO/IEC 27001.

S61 – Dry Risers

10000 Based on NES S61 TEXT Dec 19

S63 – Sprinklers

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide a pipework distribution system charged with compressed air/water with a network of heat sensitive heads. Should a space temperature rise above a critical point the adjacent head will actuate and water will be emitted into a specific area.

To provide a local storage and pressurization system to reinforce the supply authority's mains.
To provide environmental control facilities to the pump house and all necessary frost protection facilities.
Refer to clause W60 320.100 for control panel design and construction.

100.020 DESIGN PARAMETERS
To the requirements of BS EN 12845 +A2, LPC Rules and associated Technical Bulletins and the requirements of the Local Fire Officer/Local Authority as appropriate.
See Schedule of Common Design Criteria.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO S63

300.000 GENERAL

300.001 PRESSURE EQUIPMENT DIRECTIVE/PRESSURE EQUIPMENT REGULATIONS:
All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 2014/68/EU, implemented in the UK through the Pressure Equipment (Amendment) Regulations 2015 and The Pressure Equipment (Safety) Regulations 2016, must be tested by the manufacturers, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.

Only relevant equipment and assemblies certified as compliant will be permitted under this specification, and any substitution put forward must also be compliant with the Directive.

300.010 STANDARDS:
For residential and domestic occupancies for life protection comply with:
- BS 9251 and guidance in relevant section of BS 9991
- BS 9252 and/or BS EN 12259-1 for components used in the system, as appropriate to the system type and design.
- BS 9999

300.020 FIRE AUTHORITY REQUIREMENTS:
Ensure all system components are approved by a certified approving authority acceptable to the Building Control Officer, Local Fire Authority and clients insures. ie LPCB, FM, UL.
Ensure any pipework, fittings, valves and equipment directly connected to the water companies mains are WRAS approved for connection to water mains.
Comply with fire insurers requirements.

300.025 DOCUMENTATION:
Provide design, installation, test and maintenance documentation detailed within the British Standard and or LPC Rules and associated Technical Bulletins.
Provide completion certificates and documents as detailed in BS EN 12845 and specification preliminaries
Provide LPCB 1048 certificate on completion on systems design in accordance with LPC Rules.
Provide documents and maintenance log book as detailed in BS 9251 (domestic and residential applications).

300.030 SPRINKLER SYSTEMS:

300.040 WATER SUPPLY:
Provide a water supply for the system suitable for the hazard classification and design requirements
Water supply to be mains fed or pressurised with storage tank, and shall be in accordance with the design standards specified.
Where pressurised provide emergency infill connection as defined in clause 300.041

300.041 EMERGENCY INFILL UTILISING INLET BREECHING:
Standard

BS 5041-3.

Components

Instantaneous inlet couplings to BS 336.
Protecting cap retained by a chain.
Non-return valve.
Drain valve.

Breeching

Two-way breeching for 100mm riser.

Inlet box

Standard

BS 5041-5, to suit breeching inlet.

Components

Wired glazed door with lock.
Provide identification indicating 'Sprinkler System Emergency Fill'
Provide within box unit engraved multi-laminate phenolic label indicating system flow and pressure.

300.050 INSTALLER AND DETAILED DESIGNER SELECTION

Use a Specialist Company to carry out the detailed design (including hydraulic calculations) and undertake the supply, installation, commissioning and testing of the sprinkler system.

Use an installer approved by the LPCB to standard LPS 1048.
Level of contractor approval - as described in the scope of works.
The contractor shall comply with LPCB standard LPS 1148.
For residential and domestic use an installer approved by the LPCB to standard LPS 1301.

300.061 INTERFACE AND MONITORING REQUIREMENTS:

Provide interface and monitoring requirements between the sprinkler system and building services systems as detailed in the scope of works or schedules.
Monitoring shall comply with Annex H in BS EN 12845 and transmission of alarms shall comply with Annex I in BS EN 12845

300.070 INTEGRATION, CONTROL AND MONITORING:

Provide an integrated system as detailed in the scope of works / schedules.
Equipment to be controlled / monitored should interface with BMS and fire alarm system as described in the scope of works via:
Local outstations / control panels
Supervisory control and data acquisition system via:
Local outstations / control panels
Fire detection and alarm system:
Ensure interfaces to fire detection and alarm system comply with the relevant parts of BS 5839 and BS 7273.
Ensure relevant equipment complies with BS EN 50130-4.

300.080 SOFTWARE:

Obtain on behalf of the end users all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Provide documentation for application software in accordance with BS ISO/IEC 26513 and BS ISO/IEC 26514.
Ensure that, as far as practicable, all software is commercially available off-the-shelf.
Ensure that any programmable configuration, customisation, and bespoke software, is developed, tested and commissioned using relevant processes and procedures complying with BS ISO/IEC/IEEE 12207 or BS ISO/IEC/IEEE 15288 supported by a quality management system meeting the requirements of BS EN ISO 9001.

310.000 PRODUCTS/MATERIALS

310.010 AUTOMATIC PUMPS AND CONTROL PANEL FOR SPRINKLER SYSTEM

Standards

Commercial and industrial buildings

BS EN 12845
LPCB standard LPS 1131 and LPS 1240.

Domestic and residential buildings

BS 9251 (unless detailed otherwise in the scope of works or schedules)

Pump type to be sized and selected by the specialist to be suitable for the systems hazard classification, building height and the specialists hydraulic/table calculations.

Provide sprinkler pump unit either single or in a duty and standby arrangement to accord with the design standard selected, the scope of works and Schedule of Common Design Criteria A13sch.

Sprinkler pumps to be electric powered or diesel engine powered and are to be certified LPBC approved.

Each pump unit to be provided with an approved control panel housing all necessary pump starters electrical and control wiring, anti condensation heaters and indicator lamps as defined within the British Standard and required by the LPC or the selected approving standards authority

Pump unit and associated control panel and equipment are to be factory tested to the requirements of the selected standard.

Each pumping system shall incorporate a jockey pump unit to operate to maintain system pressure for small pressure losses within the sprinkler system. Jockey pump to incorporate control panel housing pump starter all necessary electrical and control wiring complete with indicator lamps and isolator / panel interlock. Panel to be manufactured and wired to the same standard as the main fire pumps.

Diesel engines for sprinkler pump sets to comply with LPBC LPS 1239.

Electric sprinkler pump control panel

Enclosure

Fabricate from mild steel sheet. 1.6mm thickness minimum, damp proof and dust proof and as detailed in Y72 Section – Contractors and starters, Control/starter panels for packaged plant.

Panel to be lockable.

Panel to incorporate a door interlocked isolator.

Comply with LPCB standard LPS 1237. All alarms to be compliant with BS EN 54-11 as appropriate.

Degree of protection to BS EN 60529 - IP54 unless detailed otherwise in the scope of works or schedules).

Components

All control and mimic panels are to be a proprietary LPCD approved package and shall be compliant with BS EN 12845 and BS EN 54-11: 2001.

Provide volt free contacts for alarm indication (by zone) for BMS monitoring.

Switching and indication

Test/off/auto.

Duty pump selection.

Power available.

Pump running/tripped (for each pump).

Low water condition.

310.011 PUMP TESTING

Provide pipework arrangement to enable all required flows and pressures of the pumps to be tested via the storage tank.

Provide on the pipework a direct reading flow meter in accordance with LPCB standard LPS 1045 mounted between two stop valves in accordance with LPS 1186. Ensure horizontal distance either side of the meter meets the manufacturer's requirements.

310.012 ELECTRIC WIRING FOR SPRINKLER PUMPS AND CONTROLS

Refer to scope of works / schedules for details of sources of the primary and secondary power supply (independent of the primary supply).

Provide all necessary certified wiring diagrams including cable sizes and installation drawings to the Electrical Contractor (or Sub Contractor) to enable them to carry out all electrical work associated with provision of power supply to the sprinkler pumps control panel as described in the scope or works. The sprinkler specialist shall ensure that the electrical wiring and power supply are designed and installed in fully compliance with the sprinkler selected design standards.

Unless described otherwise in the scope of works all other power wiring to pumps, trace heating etc and all control wiring within the pump room shall be undertaken by the Sprinkler Specialist.

310.013 PUMP INITIATION

Pump initiation shall be by pressure switch arrangement as defined in the selected design standard.

General

Include all necessary initiating pressure switches set to cut in and out as required at pre-determined values, complete with all pipework connections and test facilities.
Install the initiating pressure switches so that they are independently controlled and not 'ganged' with just a single feed pipe.

310.015 REMOTE ALARM PANEL

Provide within the sprinkler pump plantroom a remote indicator panel providing visual and audible alarm facility with volt free contacts for each alarm signal for interface onto the fire alarm system for remote indication onto the main fire panel.
Remote panel shall replicate all alarm signals from the sprinkler pump control panels together with signals from the sprinkler storage tank level alarms, zone valves and flow switches associated with the sprinkler system and any other alarm facility provided to the sprinkler system within the sprinkler pumping plantroom.

Power Supply

The panel will normally be supplied from a 230 volt mains supply.
To provide a secondary supply include for two 12 volt, 25 ampere-hour D.C. sealed lead acid batteries complete with a charger suitable for a 230 volt single phase A.C. electric supply.
Enclose the batteries in a ventilated cabinet complete with lockable access door.
Ensure that the battery capacity is capable of sustaining the standing load of the system for a period of 24 hours, plus the full alarm load for one half hour following mains failure.
The battery charger must recharge the batteries within 48 hours sufficient for full standby capacity.
Ensure the batteries have a guaranteed 5 year maintenance life.

310.021 ABOVE GROUND SUCTION TANKS (STORAGE TANKS)

For details – refer to scope of works or schedules
Standards

BS EN 12845, LPBC LPS 1276

310.031 SPRINKLER/DELUGE INSTALLATION CONTROL VALVES

Standard

BS EN 12845

Provide installation control valve assembly incorporating test facility. Unit to be LPCB approved or of an approved standard (FM, UL) agreed with the building control office and /or the clients insurer.

310.035 AUTOMATIC AIR COMPRESSOR

For systems utilising dry pipe installations provide and fit an electrically driven air compressor (suitable for sprinkler installations) complete with all necessary small bore pipe connections, fittings, unions, stop and non-return valves and pressure switches to initially charge the system with air thereafter ensure that all minor losses of air pressure are automatically restored.
Ensure that the compressor is complete with an oil and moisture trap.
Ensure that the compressor has the capacity to recharge the system to normal air pressure within 30 minutes.
Ensure the normal air pressure does not exceed 2 bars above the pressure at which the installation valves will trip.
Ensure that the automatic 'topping up' rate does not exceed 150 litres per hour.
Ensure that the sealing of the installation pipework is sufficiently good so as to prevent a pressure loss of not more than 1 bar during one week

310.040 SPRINKLER HEADS

Pattern / operation / finish as scheduled
Standard – BS EN 12259-1
Standard - BS 9252. (for domestic / residential applications)
Uninhabited parts or habitable parts with sloped ceilings within domestic and residential buildings - BS EN 12259-1

310.041 SPARE SPRINKLER/DELUGE HEADS

Provide 10 Nº spare heads for each type and model used on the project
Provide and fit in the control valve chamber the requisite number of cabinets secured by matching locks with keys containing the requisite number of each type of sprinkler head utilized complete with suitable spanners for each type of head.

310.043 SPRINKLER GUARDS

Provide and install protection strip metal guards on all low level sprinkler heads that may be liable to damage.

310.045 SPRINKLER PROTECTION WITHIN PUMPHOUSE:
Provide sprinkler protection within the pump house, supplied with water by means of a connection taken from the downstream side of the non-return valves on the pump delivery pipe.
Install on this connection a monitored stop valve, flow switch and a drain and test valve.

310.046 MONITORED ISOLATING VALVES:
Include for providing and fitting a gear operated butterfly type tamper proof monitored stop valve on each floor immediately adjacent to each riser where shown on the system drawings.

310.047 WATER FLOW DETECTORS (FLOW SWITCHES):
Standard – BS EN 12259-5
Include for providing and fitting approved flow switches in the common discharge manifold and adjacent to each isolating valve complete with test valves and site glasses coupled into the common drain pipes discharging as shown on the system drawings.

310.048 AUTOMATIC FLOW SWITCH TEST EQUIPMENT:
Provide and fit zone check automatic flow test systems

310.049 BLOCK PLANS:
Provide and fit in the control valve chamber and in the pump room a block plan showing the site, areas of protection, location of control valves and water supply, hazard classification of each area concerned, height of highest sprinkler above 'C' gauge.
Provide plans in accordance with BS EN 12845.

310.050 LOCATION PLATES:
Provide and fit on the doorway into the sprinkler control valve chamber a location plate bearing the words "SPRINKLER CONTROL VALVE INSIDE".

310.051 TEST COCKS:
Provide and fit a 25mm test cock at the highest point of each sprinkler installation.

310.052 WATER SHIELDS:
Install metal water shields of not less than 75mm diameter on all sprinkler heads any racks.

310.053 FLEXIBLE PIPES AND JOINTS:
Install flexible couplings on all pipes between the distribution mains attached to the building structure and any sprinkler piping within any storage racking.
Comply with BS EN 12845 and with LPBC Loss Prevention Standard LPS 1261 for testing of flexible hoses.

310.054 END OF LINE TEST CONNECTIONS:
Install smooth bore test nozzles at the highest/most remote point from each set of installation control valves to enable every water flow alarm device to be tested. Include for all necessary drain piping so that the water can be safely removed.

310.055 FLUSHING CONNECTIONS AND FLUSHING VALVES:
Install flushing connections at the ends of all cross mains. Each connection will consist of either a threaded nipple with cap or a mechanical grooved end cap.
Install in accordance with BS EN 12845

310.056 FIRE PROTECTION - PIPEWORK:
Provide and fit fire protection on all pipework where it through the fire lobbies and services shafts before entering the protected areas. The fire protection must appropriate fire resistance to match the building fire rating of walls / floors.
All joints and slits to be jointed with manufacturers approved sealant.
Refer to scope of works and architects drawings for details.

320.000 WORKMANSHIP

320.011 INSTALLATION
Install and test sprinkler systems in commercial and industrial buildings in accordance with LPC Rules for

Automatic installations, their technical bulletins and BS EN 12845

S63 – Sprinklers

Install, test, commission and demonstrate all fire protection systems to the requirements of local authority fire brigade and / or the building insurer.
For residential and domestic applications install and test sprinkler installation in accordance with BS 9251 and BS 9252.

320.020 QUALITY CONTROL:
Record all commissioning measurements and tests and site modifications to hardware or software, and revise operating and maintenance instructions accordingly.
Manage configuration of software, settings, data, and design, in accordance with an appropriate Configuration Management Plan complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC/IEEE 12207 and BS ISO/IEC/IEEE 15288.
Provide configuration details along with the operation and maintenance manual on hand-over.
Manage information security of systems, software and data during design, implementation and commissioning in line with BS ISO/IEC 27001.

10000 Based on NES S63 Dec 19

T14 – Heat Pumps

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES

To provide space or water heating to areas as detailed in the scope of works and drawings using air-to- air, or air-to-water or water-to-water heat pumps.

In addition to controls requirements detailed elsewhere in the specification, provide the minimum controls package for compliance with Building Regulations Approved Document L as defined in the Non Domestic Building Services Compliance Guide.

To provide an energy efficient, low carbon means of generating heating and / or cooling for the purposes of maintaining the building's internal temperature requirements and secondary hot water requirements (if required).

Refer to relevant Reference (Workmanship) Specifications / Schedules ie Y – clauses for mechanical and electrical equipment not specifically identified in this work section, including pumps, pipework, valves, insulation, motors, wiring, control panels and testing and commissioning requirements etc.

Refer to work section W60 for controls / BMS requirements.

Closed Loop Ground Source Heat Pump Systems (Vertical ground collector U tube type)

A specialist sub-contractor, with extensive experience of designing and installing closed loop ground source heat pump systems of the size described in the particular specification shall undertake the design, supply, installation, testing, commissioning and setting to work of the major components of a closed loop, borehole based, ground source heat pump system.

Taking into consideration the required thermal energy demand of the building (as schedule T14sch2), the site geology, the thermal conductivity of the ground, and the characteristics of the heat pump, the system design shall enable year on year ground thermal equilibrium and achieve the performance objectives.

In consideration of any potential congestion on the site, it is essential that the specialist sub-contractor liaises closely with the Main Contractor to ensure that the installation of the ground heat exchanger is correctly programmed into the overall work plan, so that it does not interfere with or delay any other construction activity.

100.021 DESIGN PARAMETERS

See also - Schedule of Common Design Criteria. (A13sch)

Where detail design of the system is required comply with:

- BS EN 15450 for detail design of the heat pump heating system
- BS EN 12831-1 for calculation of design heat load for space heating
- BS EN 15316-4-2 for calculation of system energy requirements and system efficiencies

All components of the refrigeration system to be designed installed tested commissioned and decommissioned to the requirements of the following:

Refer to clause W60 320.100 for control panel design and construction.

Standards/Approved codes of practice

BS EN ISO 12100 and BS EN 378 Parts 1-4 - Refrigeration systems and heat pumps – Safety and Environmental requirements, and BS EN ISO 4126-1 for safety valves

BS EN 15450 – Heating systems in buildings, Design of Heat Pump heating systems – Systems shall have a seasonal performance factor not worse than the minimum required by table C1 for new build and table C2 for existing buildings

Relevant parts of BS EN 14511 – Test conditions Air conditioners, liquid chilling packages & heat pumps with electrically driven compressors for space heating and cooling.

All parts of BS 6880 Low temperature hot water heating systems of output greater than 45kW

Relevant parts of BS EN 12201 Plastic piping systems for water

WIS 4-32-17 PE pressure pipes for pressurised water supply and sewerage duties

VDI 4640 Part 2 German std for ground source heat pump systems.

The Pressure Systems Safety Regulations 2000

The Approved code of practice to the Pressure Systems Safety Regulations (ACOP) L 122 "Safety of Pressure Systems".

Refer to schedule A37sch2 and clause A37.150.001 for requirements for a "Written Scheme of Examination" for the system.

HSC Approved Code of Practice L8 Legionnaires Disease.

CIBSE TM 13 - Minimising the risk of Legionnaires' disease

ARI 330 – Standard for Ground Source closed loop heat pump systems

HSE Guidance note PM81 – Safe management of Ammonia refrigeration systems
The 2nd tier compliance documents referred to in ADL1 and ADL2A/B of the latest edition of Part L of the Building Regulations.
The latest edition of the relevant Institute of Refrigeration (IOR) Safety Code of Practice for refrigerant used in the installation.
The IOR Code of Practice for the Minimisation of Refrigerant Emissions from Refrigerating Systems

Specific requirements for closed loop ground source heat pump systems (refer to schedule T14sch2 for system performance requirements)

The ground loop shall be designed using the appropriate ground thermal characteristics (conductivity and diffusivity) for the site. These parameters may be determined from existing information or an in-situ thermal test. The thermal modelling of the ground loop heat exchanger must take into consideration the borehole diameter, the type of grout and the u-tube pipe diameter.
The combined ground loop array and heat pump system shall be capable of delivering the specified peak output heating (and/or cooling) loads and the monthly energy quantities specified in the demand profile assessment of thermal energy.
The heat pump(s) shall be capable of delivering the specified output temperatures under all anticipated source side operating temperatures and able to achieve high average COPs and Seasonal Performance Factors commensurate with practical engineering constraints and cost effectiveness with a heating/chilled water distribution system designed for a temperature drop/rise of 5-7°C under source side EWT operating temperature limits of –5 to 15°C in heating mode and 10°C to 35°C in cooling mode.
The heat pump system shall be designed to avoid short cycling; the maximum number of start-up cycles per hour shall be limited to four.
The final number, depth and layout of boreholes, U-tube pipework diameter, length and diameter of horizontal pipework shall be arranged to meet the following hydraulic requirements:

- Turbulent flow (i.e. Reynolds Number > 2100) to be achieved under maximum demand conditions in the borehole U-tubes.
- Hydraulic pressure drop in total ground loop array (i.e. as seen by heat pump) to be <50kPa.

Equal flow rates are to be achieved in each U-tube by the use of manifolds incorporating flow balancing valves.
Ground loop design to take account of the effects of the antifreeze on viscosity and hence Reynolds number in the hydraulic and thermal design and sizing calculations.
Flushing velocity in ground collector to exceed 0.6m/s.

Where the design includes a Buffer Tanks this shall be sized to buffer heat and cooling from ground source heat pumps to minimise number of compressor starts per hour and increase over-all efficiency.

Standards: PD 5500 categroy 3, or relevant parts of BS EN 13445.
Insulation - Vessel to be insulated to and finished with hammer clad aluminum complete with Vapor sealing, thickness in accordance with Y50

100.026 HEAT PUMPS - BREEAM REQUIREMENTS:
On applicable projects and detailed elsewhere, comply with BREEAM requirements below to suit the type of construction and scheme.
BREEAM New Construction 2018 requirement
Comply with Issue ID Ene 01 Reduction of Energy Use and Carbon Emissions
Comply with Issue ID Ene 04 Low Carbon Design
Comply with Issue ID Wst 05 Adaptation to Climate Change
BREEAM Refurbishment and Fit-out 2014 requirements
Comply with Issue ID Ene 01 Reduction of Energy Use and Carbon Emissions
Comply with Issue ID Ene 04 Low Carbon Design
Comply with Issue ID Wst 05 Adaptation to Climate Change

PART 3 SPECIFICATION CLAUSES SPECIFIC TO T14

300.000 PRODUCTS/MATERIALS

300.001 PRESSURE EQUIPMENT DIRECTIVE/PRESSURE EQUIPMENT REGULATIONS:
All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 2014/68/EU, implemented in the UK through the Pressure Equipment (Amendment) Regulations 2015 and The Pressure Equipment (Safety) Regulations 2016, must be tested by the manufacturers, and be certified as compliant with the

Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.

Only relevant equipment and assemblies certified as compliant will be permitted under this specification, and any substitution put forward must also be compliant with the Directive.

300.002 GROUND INVESTIGATIONS FOR GROUND SOURCE HEAT PUMP SYSTEMS:
Standard - Undertake ground investigations and testing to Eurocode 7 (BS EN 1997 Parts 1and 2) and UK National Annex to Eurocode 7 and the guidance in Code of Practice for ground investigations - BS 5930.
Properties to be established
- Grading.
- Bearing capacity.
- Permeability.
- Water table.
- Liquefaction.
- Settlement.
- Subsidence.
- Buried services.
- Rock outcrops.

300.003 SAFETY STANDARDS AND REGULATIONS:
Comply with BS EN ISO 12100, all parts of BS EN 378, BS EN 12693 (Safety and environmental requirements of refrigerating systems and heat pumps) and BS EN ISO 4126-1 (for safety devices).
Comply with BS EN 14276-1 for general requirements of vessels.
Comply with F-Gas Regulations 2015 as amended and relevant DEFRA guidance documents.
Plant and equipment intended for use in explosive atmospheres shall be in accordance with relevant parts of BS EN 60079 and BS EN ISO 80079. Fans to comply with BS EN 14986.
Comply with BS EN 12263 for safety switching devices to limit the pressure in refrigerating systems to the limits of the refrigerating system.
Comply with relevant Institute of Refrigeration (IOR) Safety Code of Practice for refrigerant used in the installation.
Where evaporative cooling systems are to be installed, assess the system against the notification requirements defined in The Notification of Cooling Towers and Evaporative Condensers Regulations (NCTEC) 1992, and liaise with the employer to ensure a notification has been made to the Local Authority if required. Comply with HSC ACOP L8 and associated technical guidance HSG 274 Part 1 as appropriate.
Provide sample points in the cooling system pipework to enable sampling to be undertaken in accordance with BS 7592
Pipe discharges from safety valves to be located at a safe point away from any fresh air intakes or openable windows (external to the building for plant in enclosed plant rooms). The discharge point shall be such that persons and property are not endangered by a release of the refrigerant and be well away from any fresh air intakes or openable windows.

300.004A EQUIPMENT:
General (energy)
- Equipment to be in accordance with The Energy Related Products Regulations 2010 as amended.
- Heat pumps / reversible chillers with a rated heat output up to 400kW to comply with EU Regulation 813/2013 with regard to ecodesign requirements.
- Reversible chillers greater than 400kW to comply with EU Regulation 2016/2281 with regard to ecodesign requirements, including seasonal space cooling (or heating), energy efficiency (SSCE / SSHE) and product information.
- Fans incorporated into plant with electric input between 125W and 500kW to comply with EU Regulation 327/2011 with regard to ecodesign requirements.
- The seasonal energy efficiency ratio (SEER or ESEER) for use in Part L calculations to be calculated in accordance with the latest edition of the appropriate Non-Domestic Building Service Compliance Guide.

Comply with the following standards:
- Refrigerating compressors
  - Performance testing in accordance with BS EN 13771-1 and BS EN 12900
  - Use lubricating oils in accordance with BS 2626, BS ISO 6743-3 and manufacturer's recommendations.
  - Safety of motor-compressors to BS EN 60335-2-34
- Heat exchangers
  - Tubing for heat exchangers and their internal connecting to be round copper tubes, smooth or inner finned to BS EN 12735-2

Refrigerating condensers
Performance testing in accordance with BS EN 13771-2 and BS EN 13215
Motors
Comply with EC Regulation 640/2009 and amendment EU Regulation 4/2014 with regard to ecodesign requirements for electric motors
BS EN 60034-30-1 and BS EN 50347 as applicable to 3-phase cage-induction motors.
Minimum efficiency to be IE2 and be equipped with a VSD unless scheduled otherwise.
Pressure vessels
To relevant parts of BS EN 13445 and BS EN 14276-1 for general requirements for material, design, manufacturing, testing and documentation.
Valves
Design, testing, marking generally in accordance with BS EN 12284
Safety and environmental requirements in accordance with BS EN 378-2
Safety valves in accordance with relevant parts of BS EN ISO 4126. Comply with BS EN 13136 for sizing / selection of pressure relief devices for components of refrigerating systems.
Materials - Manufacturer's standard.

300.005 RENEWABLE HEAT INCENTIVE (RHI):
Where the owner of the installation wishes to claim RHI subsidy for the installation of this renewable heat technology the Contractor shall undertake, on behalf of the owner, all procurement, installation, and commissioning of the facilities and provide all necessary documentation to enable the owner to apply to Ofgem for accreditation of the installation in accordance with the RHI Regulations and the latest version of Ofgem's guidance documents.
The equipment and installation shall meet the requirements of the following:
The Renewable Heat Incentive Regulations.
Latest version of Volume 1 of Ofgem Renewable Heat Incentive Guidance: Eligibility and how to apply.
Heat metering
Provide heat meters with integrator, flow sensor, matched pair of temperature sensors and interconnecting cables and calculator / digital integrator calibrated as a single unit at manufacturer's works. Installation to be in accordance with manufacturer's recommendations.
Meter accuracy class for RHI eligibility to be class 2 as defined in Annex MI-004 of the MID / BS EN 1434-1
Heat meter duties and details as schedule reference Y11sch3.

300.006 REFRIGERANTS:
Refrigerants to have an Ozone Depletion Potential (ODP) of Zero

Comply with relevant Institute of Refrigeration (IOR) Safety Code of Practice for refrigerant used in the installation.
Comply with IOR Code of Practice for the Minimisation of Refrigerant Emissions from Refrigerating Systems.
Provide each heat pump / chiller with automatic shutdown and pumpdown of refrigerant on the detection of refrigerant leakage/charge loss. Provide automatic isolation valves to contain the refrigerant once fully pumped down.
The use of refrigerant R410A to be limited to equipment up to and including 600kW.
CFC and HCFC refrigerants are prohibited and must not be used.
BREEAM 2018 requirements - Comply with BREEAM 2018, Issue ID Pol 1 – refer to scope pf works for further details.

Where scheduled provide an automatic leak detection system. Comply with the Institute of Refrigeration Code of Practice for Minimisation of Refrigerant Emissions from Refrigerating Systems and British Refrigeration Association (BRA) Code of Practice for refrigerant leak tightness in compliance with the F-Gas Regulations 2015 as amended. Provide each heat pump / chiller package with a factory installed electronic gas detection type refrigerant leak detection system that complies with BS EN 378-3.
Automated permanent leak detection systems that are included on the ECA Energy Technology Product List shall only be acceptable.

Configure the system to provide an alarm signal.

Alarm Signal Actions (R134a, R410A, R32 @ 1000 ppm)

Alert the operator by signal to BMS.

The automatic leak detection system will be used in conjunction with regular manual leak detection carried out by the maintenance contractor in accordance with the above reference Codes of Practice.

300.008 REFRIGERANT PIPING SYSTEMS

Including all discharge lines from pressure relief devices
Comply with relevant IOR Safety Codes of Practice.
Comply with BS EN 14276-2 and relevant parts of BS EN 378 for piping general requirements.

Material

Seamless copper tube to BS EN 12735-1 for piping systems and BS EN 12735-2 for equipment, fully annealed and internally degreased and cleaned.

To be selected by the equipment manufacturer or the specialist pipework installer to suit the application, maximum operating temperature and pressure, and refrigerant.

Jointing

Do not used screwed joints in pipelines, except for connection to equipment. Do not use soft soldering for piping joints.
Brazing - comply with British Refrigeration Association (BRA): Jointing of Copper Pipework for Refrigeration Systems - Specification & Procedures for Manual Torch Brazing and Brazer Assessment.

Insulation

On internal pipelines, insulate suction pipe from evaporator to compressor.
On external pipelines, insulate both suction and discharge pipes and protect from solar radiation where pipework is not otherwise shielded.

Arrange all exposed pipe runs to present neat appearance, parallel with other pipe or service runs and building structure, subject to gradients for draining or venting. Discharge lines from safety devices shall be installed so that persons and property are not endangered by the release.

Ensure all vertical pipes are plumb or follow building line.
Support all pipework and controls cabling throughout their length using cable tray, firmly fixed to the building fabric.
Space pipe runs in relation to one another, other services runs and building structure, allow for specified thickness of thermal insulation and ensure adequate space for access to pipe joints, etc.
All refrigerant pipework insulation at low level or in locations where mechanical damage could occur or which could be damaged by UV radiation shall be suitably protected

300.015 ECODESIGN / EER REQUIREMENTS FOR AIR CONDITIONERS / HEAT PUMPS:

Equipment to be in accordance with The Energy Related Products Regulations 2010 as amended.
Fans incorporated into plant with electric input between 125W and 500kW to comply with EC Regulation 327/2011. Units with a rated capacity of up to 12kW to comply with EC Regulation 206/2012. Other plant to comply with EU Regulation 2016/2281, including Seasonal Space Cooling (or Heating) Energy Efficiency (SCEE / SHEE) and product information / instruction manuals information on disassembly, recycling and/or disposal.
The full load (cooling) Energy Efficiency Ratio (EER) of plant shall be as detailed elsewhere in this specification but shall not be less than the minimum values given in the latest edition of the appropriate Non-Domestic Building Services Compliance Guide.

300.020 AIR-TO-AIR HEAT PUMPS:

Standards

BS EN 14511 parts 1, 2, 3&4 for classification, testing /operating requirements, marking and instructions.
BS EN 14825 for testing and rating at part load conditions and calculation of seasonal performance
BS EN 12693 (positive displacement compressors)
Relevant parts of BS EN 378 for safety and environmental

On applicable projects comply with international standards

BS ISO 5151 for non-ducted air-cooled air conditioners and air-to-air pumps.
BS ISO 15042 for multi-split systems, modular multi-split systems and modular heat recovery multi-split systems.
BS ISO 13253 for ducted air-cooled air conditioners and air-to-air heat pumps.
Relevant parts of BS ISO 16358 for testing and calculation of seasonal performance factors

Acoustic

Determine sound power levels in accordance with BS EN 12102-1

Supply heat pump complete with inside and outside refrigerant coils, condensate drain on both coils, compressor, crank case heater, reversing valve, expansion valves, check valves and accumulator.

Casing

Ensure casing has no sharp edges. Protect against corrosion internally and externally. Line rigid frame with thermal and acoustic insulation.

Material

Manufacturer's standard casing.

Finish

Manufacturer's standard finish.

300.030 AIR-TO-WATER HEAT PUMPS:

Standard

BS EN 14511 parts 1, 2, 3&4 for classification, testing /operating requirements, marking and instructions.
BS EN 14825 for testing and rating at part load conditions and calculation of seasonal performance
Relevant parts of BS EN 378 for safety and environmental
BS EN 12693 (positive displacement compressors)
BS EN 16147 (domestic hot water)
Relevant parts of BS EN 378

On applicable projects comply with international standards for testing and rating for performance

BS ISO 19967-1 for air source heat pump water heaters for hot water supply only with or without supplementary electric heater connected to a hot water storage tank.
BS ISO 19967-2 for air source heat pump water heaters for space heating only.

Acoustic

Determine sound power levels for space heating and cooling units in accordance with BS EN 12102-1
Determine sound power levels for domestic hot water heaters in accordance with BS EN 12102-2

Supply heat pump complete with inside and outside refrigerant coils, condensate drain on outside coil, pipework connections to system, compressor, crank case heater, reversing valve, expansion valves, check valves and accumulator.

Casing

Ensure casing has no sharp edges. Protect against corrosion internally and externally. Line rigid frame with thermal and acoustic insulation.

Material

Manufacturer's standard casing.

Finish

Manufacturer's standard finish.

300.032 WATER-TO-AIR HEAT PUMPS:

Standards

Safety and environmental

BS EN 378 parts 1-4
BS EN 12693 for positive displacement refrigerant compressors.

Classification, testing / operating requirements, marking and instructions.

BS EN 14511 parts 1-4
BS EN 14825 for testing and rating at part load conditions and calculations and calculation of seasonal performance.

Acoustic

Determine sound power levels in accordance with BS EN 12102-1

Casing

Ensure casing has no sharp edges. Protect against corrosion internally and externally. Line rigid frame with thermal and acoustic insulation.

Material

Manufacturer's standard casing.

Finish

Manufacturer's standard finish.

300.040 BRINE OR WATER-TO-WATER HEAT PUMP:

Supply heat pump complete with evaporator and drain pan, compressor, condenser and expansion valve.

Standards

BS EN 378 Relevant parts of BS EN 378 for safety and environmental
BS EN 14511 parts 1-4 for classification, testing /operating requirements, marking and instructions.
BS EN 12693 (positive displacement compressors)
BS EN 16147 (domestic hot water) .
BS EN 14825 for testing and rating at part load conditions and calculations and calculation of seasonal performance.

Acoustic

Determine sound power levels for space heating and cooling units in accordance with BS EN 12102-1
Determine sound power levels for domestic hot water heaters in accordance with BS EN 12102-2

The heat pump cabinet is to provide acoustic protection and compressors are to be mounted on internal anti-vibration mounts. Heat pump to be supplied with anti-vibration mounts.
On water-to-water chiller/heat pumps (non reversible type) the manufacturer's controls shall enable the control of both evaporator leaving temperature and condenser leaving temperatures as standard.
Ensure that minimum condenser return temperatures are kept above the manufacturer minimum recommendation.

300.041 GROUND SOURCE HEATPUMPS:

Standards – closed loop ground to air

BS EN 378 parts 1-4 for safety and environmental
BS EN 12693 for positive displacement refrigerant compressors.
ANSI/AHRI/ASHRAE ISO Standard 13256-1 for compliance with Part L Non Domestic Building Services Compliance Guide.
BS EN 14825 for testing and rating at part load conditions and calculation of seasonal performance.
VDI 4640 Parts 1-4

Standards – closed loop ground to water

BS EN 378 parts 1-4
BS EN 12693 for positive displacement refrigerant compressors.
Classification, testing / operating requirements, marking and instructions -BS EN 14511 parts 1-4
ANSI/AHRI/ASHRAE ISO Standard 13256-2 for compliance with Part L Non Domestic Building Services Compliance Guide.
International Ground Source Heat Pump Association Closed-Loop/Geothermal Heat Pump Systems Design and Installations Standards.
VDI 4640 Parts 1-4

Acoustic

Determine sound power levels for space heating and cooling units in accordance with BS EN 12102-1
Determine sound power levels for domestic hot water heaters in accordance with BS EN 12102-2

Refrigerant -Heat pumps shall use a zero ODP refrigerant that complies with all current UK legislation.
Supply heat pump complete with compressor, condenser, expansion valve and integral controls.
Compressors to be mounted on anti-vibration mounts.
Controls on non reversible type heat pumps to enable control of both evaporator and condenser leaving temperature.
Ensure minimum condenser water return temperatures do not fall below the manufacturers' minimum recommendation.

The Specialist ground source heat pump contractor shall provide manufacturer's technical data in the tender submission, detailing heating and/or cooling outputs (as appropriate) and COP's at quoted operating conditions. This should include conditions at or close to 0°C EWT in heating mode, and 35°C EWT in cooling mode, with stated output load side flow temperatures.

Ancillaries

Microprocessor controller complete with integral protection devices, fault indication, logging and facility to output common fault alarm.
Facility for remote enable of heat pumps.
All power and control facilities for controlling ground loop primary circulating pumps.
All internal and external sensors and controls to facilitate weather compensation of set points for heating and/or cooling.
Modem for BMS communication with heat pump via open protocol.

300.042 DEMAND PROFILE OF THERMAL ENERGY REQUIRED FROM GROUND SOURCE HEAT PUMP SYSTEM:

The ground source heat pump specialist contractor shall use the scheduled design data to size the collector system and select correctly matched heat pump(s).

300.043 DESIGN INFORMATION REQUIRED FROM GROUND SOURCE HEAT PUMP SPECIALIST:

The following shall be provided by the Ground Source Heat Pump specialist:

Design Stage

- Ground modelling output
- Hydraulics calculations
- Heat pump technical data

- Circulation pump technical data
- Buffer tanks and DHW cylinder technical data
- Schematic
- Borehole layout drawing
- Standard details drawing
- Designers risk assessment

Construction stage

- Risk Assessments
- Method Statements
- Test and commissioning certificates
- operating and maintenance instructions
- As installed drawings including the ground loop array and header pipework.
- O&M manual

Pressure testing records and commissioning performance records to be included

For systems using load bearing thermal piles refer to 300.055 for detailed requirements. For roles and responsibilities refer to schedule T14Sch2

For systems using boreholes / energy piles refer to 300.050 for detailed requirements.

For systems using horizontal collectors refer to 300.060 for detailed requirements.

300.044 PACKAGED SIMULTANEOUS HEATING AND COOLING UNIT

(Copy of clause T60 310.054)

Type – refer to schedules or particular specification scope of work.

Air source - Package to include: compressors; evaporator for chilled water production; water cooled condenser for hot water generation; auxiliary air source heat exchanger used as an evaporator for hot water production and a condenser for chilled water production; heat rejection fans, starting and control equipment and all auxiliary and ancillary items to complete refrigeration cycle.

Auxiliary air source heat exchanger coil – copper tubes with aluminium fins. Fins to be epoxy coated in corrosive environments including coastal locations, swimming pools, airports, inner cities.

Ground source water cooled - Package to include: compressors; evaporator for chilled water production; water cooled condenser for hot water generation; auxiliary water source heat exchanger used as an evaporator for hot water production and a condenser for chilled water production; starting and control equipment and all auxiliary and ancillary items to complete refrigeration cycle.

Unit and packaged controls to be capable of proving either full cooling / zero heating, full heating / zero cooling, full cooling / partial heating, full heating / partial cooling or full cooling / full heating.

Auxiliary ground source heat exchanger – as scheduled.

300.050 VERTICAL GROUND ARRAY COLLECTOR:

The specialist Ground Source Heat Pump sub-contractor shall assess ground conditions, develop design, supply, install (including drilling of bore holes), inserting collector, grout and connection to manifold collector. Scope of work to include all civil works, commissioning and setting to work the borehole.

Standards

Latest version of Ground Source Heat Pump Association Closed Loop Vertical Borehole Standards.

or

German standard VDI 4640 Part 2

Supply vertical ground collector, manifold and circulation pump.

The ground loop shall consist of vertical boreholes incorporating specialist ‘geothermal’ U-tubes

U-tubes shall be factory fabricated, using 32mm or 40mm OD HDPE, SDR-11, and PE100 to BS EN 12101-1, the OD size shall be selected by the specialist sub-contractor to suits the hydraulics of the system. U-tubes shall be of continuous length (i.e. no joins/ welds) other than for U-bend. U-bend to be single moulded piece and to be factory welded to the pipe tails.

Horizontal connecting pipework shall be black Medium Density Polyethylene PE 80 SDR-11. Mark all horizontal pipework using suitable detectable marker tape laid 200mm above buried pipework

Borehole grout shall be selected by the ground source heat pump specialist according to the ground loop heat exchanger design..

The grout is required to achieve the low permeability (i.e. $1x10^{-7}$ -$1x10^{-9}$ cm/sec) required to resist the through-flow of ground water and yet retain a pumpable consistency for an adequate period of time. Grout is to be injected over the full length of the boreholes, using tremmie pipes inserted to the bottom of the borehole, and withdrawn during grout injection.

Glycol protection shall be provided treated with inhibitors and biocide to prevent corrosion and biological growth. Freeze protection to be to below the lowest temperature modelled by the specialist ground source heat pump company in the ground loop array and heat pump evaporator.

'Buffer' tanks shall comply with PD 5500 category 3 or BS EN 13445 and shall be insulated with at least 50mm CFC/HCFC free spray foam insulation and with operating pressure range to 0.3MPa

Circulating pumps be suitable for chilled water with ethylene glycol or other anti-freeze as selected, in accordance with BS EN IS0 9908, BS EN 12756 and Y20 clauses generally.

300.055 LOAD BEARING THERMAL PILES FOR GROUND SOURCE HEAT PUMP / CHILLER:

Type – as schedules

Engage a ground source heat pump specialist designer / contractor to undertake the following:

- To supervise the fixing, installation and to ensure the integrity of the loops during installation of the piles and header pipe works and plant room.
- Determine the heating and cooling potential of the thermal loops.
- Liaise with the M&E Designer regarding how the works fit within the overall M&E design for the building.
- Taking into account the ground conditions optimise the thermal loop layout within the piles in order to produce a design appropriate to the specification.
- Assessment of the building thermal loads provided by the M&E Designer.
- Design of thermal pile loop details and header pipe layout to meet thermal loads defined by the M&E Designer whilst meeting the ground temperature limits agreed with the Pile Designer.
- Input into pile specifications and preliminary / contract pile test.
- Develop preliminary drawings for pile loops and header pipe layouts for approval with the Pile Designer.
- Produce final drawings for pile loop layout and header pipe layouts.

Comply with BS EN 16228-1 and any other parts of this standard relevant to the particular requirements of the project. Any machinery used, to be in accordance with BS EN ISO 12100

Frost protection

- Glycol protection to be provided treated with inhibitors and biocide to prevent corrosion and biological growth.
- Freeze protection to be below the lowest temperature modelled by the specialist ground source heat pump company in the collector and heat pump evaporator.

Duty – refer to schedule / scope of works

Pipe material

- PE 100+ to BS EN 12201-2 –or PE 100 RC to PAS 1075

Circulating pumps be suitable for chilled water with ethylene glycol or other anti-freeze as selected, in accordance with BS EN IS0 9908, BS EN 12756 and Y20 clauses generally.

300.060 HORIZONTAL GROUND ARRAY COLLECTOR:

Supply heat pump complete with horizontal ground collector and circulation pump.

Standard

- Ground Source Heat Pump Association (GSHPA) Shallow Ground Source Standard.
- or
- German standard VDI 4640 Parts 1and 2

Engage a ground source heat pump specialist to undertake detail design of the collector system, insert collector and connect to manifold chamber. Scope of work to include all civil works, commissioning and setting to work of the ground collector.

Supply horizontal ground collector, manifold and circulation pumps.

Frost protection

- Glycol protection to be provided treated with inhibitors and biocide to prevent corrosion and biological growth.
- Freeze protection to be to below the lowest temperature modelled by the specialist ground source heat pump company in the ground loop array and heat pump evaporator.

Mark all horizontal pipework using suitable detectable marker tape laid 200mm above buried pipework.

Circulating pumps be suitable for chilled water with ethylene glycol or other anti freeze as selected, in accordance with BS EN IS0 9908, BS EN 12756 and Y20 clauses generally.

300.065 **OPEN LOOP BOREHOLE PLATE HEAT EXCHANGERS:**
The materials used for heat exchangers shall be suitable for the borehole water quality/ analysis detailed elsewhere.
Water with chloride content in excess of 200mg/L - 316L or 317L stainless steel
Water with low chloride (<150mg/L and <60°C). – 304 stainless steel

300.070 **ABSTRACTION AND RECHARGE BOREHOLES (OPEN LOOP GSHP):**
The borehole shall be designed in accordance with German standard VDI 4640 and CIBSE TM45.
Engage a borehole specialist to develop design, supply, install including all civil works, commission and set to work the borehole. Obtain consent to drill test borehole from Environment Agency (EA) or Scottish Environmental Protection Agency (SEPA) before starting work. Subject to EA or SEPA approval, satisfactory water quality and flow rate, install, including all civil works, commission and set to work the borehole. Obtain licence to abstract and discharge or re-inject (if required).
Provide on-site settling tank to capture the mud from drilling. Obtain temporary discharge of effluents from Local Water Authorities.
Ensure that the recharge pipework always returns the water below the recharge well water line.
All material used to be galvanized, PE-Xa to BS EN 15875 in open trench or PE100 to BS EN12201 in conduits, do not use cast iron pipework.
Provide anti-vacuum valves and de-aeration and ensure air does not get in contact with the borehole water.
The following clauses (300.071 – 300.082) refer to the works associated with the borehole and array collectors.

300.071 [S16: 310.050] PIPE LAYING:
Use slings that do not damage either pipe or coating. Thoroughly inspect pipes prior to slinging.
Do not lower pipes until the trench bottom has been approved to receive the pipes. Ensure pipes are in correct alignment and orientation, concentric with the pipes already laid.
Make joints in accordance with manufacturer's instructions using the proprietary materials indicated.
Use a purpose made adapter for joints between pipes of different materials. If none is available, abut the pipes, tape and seal the gap, surround by 1/2 sections or less for 1m either side of the joint and surround in C20 concrete 150mm thick for 2m either side of the joint.
Perform all joints in factory conditions where possible. Where joints are manufactured on site, ensure clean working environment and wipe pipework with alcohol solution prior to jointing.

Materials

PE100 SDR11 rated for 16 bar pressure to BS EN 12201- part 1 to 3 (2003) or PE-Xa to BS 7291-3 (up to 40^0C fluid temperatures). For higher temperature application (>40°C) and for solar recharge or waste heat recharge applications, use onlyPE-Xa to BS 7291-3.

The circuitry should be designed so that as few joints as possible are inaccessibly located in the ground. Manifolds should in general be installed in accessible connection shafts or in other suitable structures.

300.072 [S16: 310.060] STRUCTURES:
Ensure pipes in and out of structures are as short as possible. Surround by concrete at least 150mm thick. Set pipes sufficiently steep to prevent the possibility of differential settlement causing a backfall.
Ensure pipework is long enough to reach the manifold without requirement for buried joints.

300.073 [S16: 310.070] BEDDING, PROTECTION AND BACKFILL:
Make cavities in the bedding to facilitate sling removal. Elsewhere smooth the trench bottom. Prepare one full pipe length in advance of pipelaying.
Locate interfaces between backfilled materials to the weaker material side of theoretical.
Concrete is the strongest and selected fill the weakest. Lay all fill less than 300mm above the top of the pipe barrel in 150mm layers and hand compact. Above this level layers may be 225mm. Over 1m above top of pipe mechanical compaction may be used.

300.074 [S16: 310.080] BACKFILLING OVER CONCRETE:
Do not start backfilling within 24 hours of placing concrete. Do not use heavy compactors and prevent imposition of traffic loads within 72 hours of placing concrete.

300.075 [S16: 310.090] TEMPORARY BRIDGES:
Provide temporary bridges over trenches as necessary to prevent construction traffic damaging pipes after backfilling.

300.076 [S16: 310.100] WARNING MARKER TAPES:
Lay during backfilling in a continuous line over pipelines, 300 to 400mm below the level of the finished surface.
Lay an additional marker 600mm above the top of the pipeline for pipes at a greater depth than 800mm.

Warning tape should be made from polyethylene and be a minimum thickness of 100 microns, it should clearly state it is a geothermal pipe below

300.077 [S16: 320.060] WATER TESTING OF MANHOLES/INSPECTION CHAMBERS:
Before backfilling test each manhole or chamber in accordance with BS EN 752, paragraph 25.7 for
Exfiltration
Ensure drop in water level is less than relevant dimension in Table 9.
Infiltration
Inflow to be not more than 5 litres per hour per manhole

300.078 [S16: 340.010] PIPELINE ROUTES:
Ensure pipeline routes are as short as possible consistent with,
natural topography and subsoil conditions.
as far as possible increasing slopes downstream.
avoidance of tree root growth areas.

300.079 [S16 340: 020] MATERIALS IN THE WORKS:
Inspect all buried materials prior to installation. Make good damaged coatings and cut ends.
Reject where damage is more than superficial.

300.080 [S16: 340.030] QUALITY CONTROL:
Check that all materials comply with the indicated standard before acceptance to store. Transport, handle and store in accordance with manufacturer's recommendations, to avoid damage or contamination.
Obtain all components for each type of pipework from the same manufacturer.
Ensure cut ends of pipes are clean, square and free of burrs.
Prepare trenches to receive pipes and allow for jointing, testing and removal of slings.
Install all components in accordance with the manufacturer's recommendations.
Joint according to manufacturer's recommendations and allow for movement, taking particular care next to buildings and manholes.
Prevent entry of foreign matter and clean prior to testing or putting to use.
Backfill and compact in layers to ensure adequate consolidation.

300.081 [S16: 340.070] SUPPORTS:
Arrange supports for control components to ensure no strain is imposed on components.

300.082 [S16: 340.080] ACCESS:
Arrange control components to ensure adequate access for operation and maintenance

300.090 GAS-FIRED SORPTION HEAT PUMPS:
Standard
Units with net heat input not exceeding 70kW - relevant parts of BS EN 12309
Types
Water to water or closed ground loop to water or air source to water as scheduled, either condensing absorption, or absorption or Adsorption as scheduled.
Supply heat pumps each complete with modulating air source fan, generator, gas burner and flue system/terminal, condenser, solution pump, evaporator, absorber and all necessary controls / safety devices to operate as a stand-alone unit.
Configuration and pre-fabrication requirements
Single units to be supplied as individual unit for complete installation on site or multiple units to be supplied factory-assembled on a pre-fabricated galvanised skid as detailed below:
Skid to include all necessary interconnecting pipework and power / control wiring to comprise a multi-heat pump cascade system.
Skid assembly to be complete with flow and return water pipework manifolds with isolation valves for connection to heating system, gas manifold with isolation valves and trace heated condensate drain pipework.
Skid assembly to include main control panel for incoming mains power and BMS connection. Panel to include BMS interface with each heat pump, power and control wiring to each heat pump and sequence controls for cascade operation.
Each heat pump unit to be complete with a primary pump capable of modulating flow rate via heat pump packaged controls.
Duty – refer to schedules
Control requirements
Each heat pump to be complete with control panel for stand-alone operation and BMS interface.

Multiple skid mounted heat pumps to be complete with main control panel with sequence control facilities for cascade operation and BMS interface (as scheduled) .
Provide weather compensation of heating flow temperature.

Accessories (unless scheduled otherwise)
Primary circulation pump
Anti-vibration mountings
Condensate pump

300.094 GAS ENGINE DRIVEN HEAT PUMPS- AIR OR WATER SOURCE (NES 300.094/ 300.096):

Type – as scheduled
Standards - Units with net heat input not exceeding 70kW - relevant parts of BS EN 16905
Supply heat pump complete with gas-fired engine driven compressor(s), evaporator, condenser and all necessary controls / safety devices to operate as a stand-alone unit.
Configuration and pre-fabrication requirements
Single units to be supplied as individual unit for complete installation on site or multiple units to be supplied factory-assembled on a pre-fabricated galvanised skid as detailed below:
Skid to include all necessary interconnecting pipework and power / control wiring to comprise a multi-heat pump cascade system.
Skid assembly to be complete with flow and return water pipework manifolds with isolation valves for connection to heating system, gas manifold with isolation valves and trace heated condensate drain pipework.
Skid assembly to include main control panel for incoming mains power and BMS connection. Panel to include BMS interface with each heat pump, power and control wiring to each heat pump and sequence controls for cascade operation.
Each heat pump unit to be complete with a primary pump capable of modulating flow rate via heat pump packaged controls.

Duty – refer to schedules
Control requirements
Each heat pump to be complete with control panel for stand-alone operation and BMS interface
Multiple skid mounted heat pumps to be complete with main control panel with sequence control facilities for cascade operation and BMS interface as scheduled
Provide weather compensation of heating flow temperature

Accessories (unless scheduled otherwise)
Primary circulation pump
Anti-vibration mountings
Condensate pump

310.010 INSTALLATION:

Install heat pump systems in accordance with manufacturer's recommendations and BS EN 14336.

Relevant to ground source heat pump systems

The Contractor shall include in the installation all necessary facilities, to enable a Specialist to successfully fill, drain, flush, clean, and chemically treat the system (refer to schedule Y25 for system further details) in accordance with the latest edition of BSRIA Guide BG29 “Pre-commissioning cleaning of pipework systems.
The Contractor shall review all designs to ensure that systems are commissionable in accordance with the CIBSE commissioning code W and BSRIA Guide BG2/2010 (Commissioning Water Systems) as detailed in Y51. If additional facilities are required the Contractor shall advise the designer prior to commencing work on site.

The ground source heat pump specialist shall submit a Method Statement and Risk Assessment for the installation.
The ground source heat pump specialist shall produce drawings showing proposed borehole layout, associated horizontal pipework / manifold arrangements and flow /return pipework to plant room, together with plant room termination arrangements.
Borehole drilling shall be undertaken by competent specialist drillers operating drill rigs in compliance with relevant parts of BS EN 16228 – Drill Rigs Safety, BS EN 12100 – Safety of machinery, and including fixed or interlocked guarding where required.
Each borehole shall be in alignment to such an extent that the closed-loop piping can be placed to the entire borehole depth and such that the borehole does not intersect another nearby borehole. Boreholes shall be spaced at a minimum of 5m centres to mitigate the risk of intersection.
Polyethylene pipework in horizontal trenches shall be laid at a nominal depth of 900mm below finished level with a 100mm thick bed and surround of course sand in order to avoid pipe abrasion. Remainder of trench to be backfilled with suitable excavated material or imported fill.

All horizontal pipework to be marked using suitable detectable marker tape laid 200mm above buried pipework.
All sub-surface connections of the polyethylene (PE) pipework to be made using electrofusion welding, carried out to UK gas specification by competent operatives. All plastic welding shall be carried out in suitable weather / environmental conditions. No mechanical jointing shall be used for buried pipework connections.
All ground loop heat exchanger pipework above ground will be insulated with flexible, closed cell, elastomeric, nitrile rubber insulation specified by the specialist subcontractor. Insulation shall be fibre free and CFC free with an ODP of zero
In permanent bypasses in any geothermal distribution system where the dead leg is more than 3 times pipe diameter suitably sized drain valves should be incorporated to facilitate draining and cleaning.

Install heat pump in accordance with manufacturer's recommendations and the requirements of HVCA TR 30.

310.011 **TESTING AND COMMISSIONING:**
Commission plant and systems served in accordance with manufacturer's recommendations, relevant CIBSE Commissioning Codes and BSRIA guides and Section 6 of BS EN 15450.

Relevant to ground source heat pump systems (NES 310.020)

U-tubes for the boreholes shall be pressure tested, as a minimum, after installation in the boreholes and prior to grouting to maximum working pressure + 5 bar for a period of 0.5 hours, in accordance with HVCA TR6. The U-tubes will be flow tested after installation in the boreholes and prior to grouting.
After flow and return headers have been connected to the borehole U tubes, the entire ground heat exchanger pipework shall be pressure tested as above prior to backfilling of any trenches for a test period of 2 hours.
Following connection to the heat pumps and ground circulating pump(s) the ground heat exchanger hydraulic circuit shall be flushed and purged of all air, charged with anti-freeze, biocide and inhibitor (as recommended by the water treatment specialist) and left in a pressurised state (approx 1 bar). Flushing velocity in ground collector to exceed 0.6 m/s.

10000 Based on NES T14 TEXT Dec 19 and NES S16 text March 18

T20 – Primary Heat Distribution

Incorporating T30 (MTWH) and T31 (LTHW) and T42 (Local heating units)

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide a piped hot water heating distribution system from the plantroom to the heat emitting equipment.
To provide all heat emitting items related specifically to the heating system and comply with BS 6880 Parts 1and 2 - Code of practice for Low temperature Hot Water Heating where applicable.

On applicable projects provide a heat network designed, installed and commissioned following the requirements of CIBSE / CHPA CP1 and to provide heat interface units connected to the heat network or other heat distribution system from a central energy centre or CHP plant. Comply with the guidance in BESA DHC01 for the minimum requirement for space, structural, access and services allowances for a building likely to be connected to a district energy network.
On applicable projects in London follow the guidance in the London Heat Network Manual.

To provide local gas fired radiant or convective heaters.

For pre-insulated underground heating distribution pipework refer to Y10 clauses including 2881, 2882 and 9060 and schedule T20sch3 or Y10sch2.

100.020 DESIGN PARAMETERS
See Schedule of Common Design Criteria.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO T20 (T30, T31, T42)

300.000 GENERAL
Refer to Y10 and Y11 for pipework and pipeline ancillaries installation and workmanship detail requirements.
Refer to Y25 for cleaning and chemical treatment requirements.
Install suitably sized safety valves in all secondary distribution pipework from heat exchangers.

300.001 PRESSURE EQUIPMENT DIRECTIVE/PRESSURE EQUIPMENT REGULATIONS:
All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 2014/68/EU, implemented in the UK through the Pressure Equipment (Amendment) Regulations 2015 and The Pressure Equipment (Safety) Regulations 2016, must be tested by the manufacturers, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.

Only relevant equipment and assemblies certified as compliant will be permitted under this specification, and any substitution put forward must also be compliant with the Directive.

300.011 SITE DIMENSIONS:
Check dimensions on site prior to ordering.

300.012 ECODESIGN REQUIREMENTS FOR LOCAL SPACE HEATERS: (T42)
Equipment to be in accordance with The Energy Related Products Regulations 2010 as amended.
Space heaters up to 120kW to comply with EU Regulation 2015/1188 for seasonal space heating energy efficiency (SHEE), NO_x emissions and product information / instruction manual.

300.020 WATER TREATMENT AND QUALITY:
Refer to scope of works / schedules for water treatment methods / facilities and conditions / properties to be achieved in the circulation water.
Circulation water quality in district heating systems to be in accordance with recommendations in PD CEN/TR 16911. (Recommendations for circulation water in industrial and district heating systems and their operation)

300.021 TESTING:
Test relevant plant equipment at manufacturer's works to appropriate British Standard to suit pressure and temperature conditions of system.

300.025 SAFETY OF WATER BASED HEATING SYSTEMS:
For water based heating systems in buildings with a maximum operating temperature of up to 105°C, provide and install facilities to ensure safety arrangements comply with Section 4.6 in BS EN 12828.
Comply with Annexe E in BS EN 12828 for safety valves in heating systems in addition to the relevant product standards referred to in Y11.

300.030 UNDERFLOOR HEATING INSTALLER SELECTION:
Use a specialist companies to carry out the design, supply, installation, testing and commissioning of the underfloor heating system in accordance with BS EN 1264. The specialist shall advise the size of cupboard, preferred location and access requirements for the manifolds, and associated valves / controls to the Contractor.
Use one of the specialist companies listed in schedule A30M Schedule of Mechanical Manufacturers to carry out the design, supply, installation, testing and commissioning of the under-floor heating system.

310.000 PRODUCTS/MATERIALS

310.021 RADIATORS, CONVECTORS AND TRENCH HEATING GENERALLY: (T31)
Ensure radiators and convectors are manufactured to BS EN 442-1 and tested/rated in accordance with BS EN 442-2.
Ensure fan assisted radiators, convectors and trench heaters are manufactured to BS EN 16430-1 and tested/rated for thermal output in accordance with BS EN 16430-2.
When fan assisted radiators, convectors and trench heaters manufactured to BS EN 16430-1 are to provide cooling they shall be tested / rated for thermal output in accordance with BS EN 16430-3.

Duty and type as scheduled.
Connections
For Steel - Wrought iron bosses welded on at manufacturer's works.
For Cast Iron and Aluminium – Integral screwed
Air cock
Provide return end air cock recessed within unit length.
Finish
Degrease and protect against rusting before application of a high quality stove primer and then powder coat with epoxy polyester, unless otherwise indicated.
Testing
Pressure test not less than 7 bar (gauge) or one and a half times maximum working pressure whichever is greater.
Accessories
Wall/floor brackets or feet as required.

310.030 PRE-INSULATED UNDERGROUND PIPELINES:
Refer to Y10 clauses, including
2881 Pre- insulated underground bonded pipe systems - steel
2882 Pre-insulated flexible insulated underground pipelines – metal and plastic service pipes
9060 Installation of thermally insulated underground pipelines
For project particular requirements refer to schedule T20sch3 or Y10sch2 / scope of works.

310.062 LOW SURFACE TEMPERATURE RADIATORS / CASING: (T31)
Duty as scheduled, to comply with NHS guidelines.
Manufacture emitter in accordance with BS EN 442-1
Thermal output and pressure drop testing/rating to be in accordance with BS EN 442-2
Material – Mild steel (min thickness 1.5mm) powder coated with antibacterial protection
Casing
To have fully radiused corners, and be a one-piece construction which does not require assembly. Cut-outs for pipework, skirting and vinyl flooring etc to be provided during manufacture to eliminate site cutting.
Front panel to be hinged for cleaning.
Grilles to be pencil proof and designed to prevent fingers being trapped. For secure environments the unit shall be tested as being anti-ligature,
LST types in secure environments to have heavy duty cases and be tested as being “anti-ligature” design including providing mesh behind grilles.
Ensure all hot surfaces are concealed and exposed surfaces remain at a temperature of no more than 43°C.
Accessories – unless scheduled otherwise provide:
Air vent and drain cock.

Front panel to be hinged for deep cleaning.
Welded feet and top stay.
Wall brackets.
Plinth for floor mounting to accommodate pipework

310.064 FAN ASSISTED RADIATORS / CONVECTORS: (T31)

Duty and type as scheduled.
Standards
Sound power levels to be measured in accordance with BS EN ISO 3744
Ensure heat emitters are manufactured to BS EN 16430-1 and tested/rated for thermal output in accordance with BS EN 16430-2 and BS EN 442-2
Details – unless scheduled otherwise
Fans / motors
Multiple axial type, fixed to the finned convector using manufacturer's mounting kit complete with modulating speed control or single centrifugal crossflow fan with EC motor and modulating speed control as scheduled.
Controls
Integral temperature sensor and controls to automatically start and modulate fans for morning boost.
Boost switch integrated into radiator to override normal temperature control.
Connections
Brass.
Finish
Degrease and protect against rusting before providing corrosion protection by phosphating followed by powder coating with epoxy polyester unless scheduled otherwise .
Testing
Pressure test at not less than 7 bar (gauge) or one and a half times maximum working pressure, whichever is greater.
Thermal output and pressure drop testing/rating to be in accordance with BS EN 442-2
Accessories / options
Air vent and drain cock.
Wall brackets.

310.066 VENTILATION RADIATORS / CONVECTORS: (T31)

Duty and type as scheduled.
Standards
Sound power levels to be measured in accordance with BS EN ISO 3744
Ensure heat emitters are manufactured to BS EN 16430-1 and tested/rated for thermal output in accordance with BS EN 16430-2 and BS EN 442-2
Details – unless scheduled otherwise
Controls
Integral temperature sensor and controls to automatically start and modulate fans for morning boost.
Boost switch integrated into radiator to override normal temperature control.
CO_2 sensor to control outside ventilation and room exhaust ventilation.
Connections
Brass.
Finish
Degrease and protect against rusting before providing corrosion protection by phosphating followed by powder coating with epoxy polyester.
Colour as scheduled
Testing
Pressure test at not less than 7 bar (gauge) or one and a half times maximum working pressure, whichever is greater.
Pressure drop testing to be in accordance with BS EN 442-2
Accessories / ancillaries
Air vent and drain cock.
Wall brackets.
Outside air inlet louvre – details as scheduled

310.070 NATURAL CONVECTOR HEATERS: (T31)

Duty as scheduled.

Type - Wall mounted low water content convector unless scheduled otherwise
Standards
Ensure natural convector heaters are rated in manufactured accordance with BS EN 442-1.
Thermal output and pressure drop testing/rating to be in accordance with BS EN 442-2
Arrangement as scheduled
Casing
Construct casing from rigid heavy gauge sheet steel, strengthened to prevent drumming, with no sharp edges for safety. Support heating element from casing and ensure casing prevents air by-passing.
Fit foam plastic strips to flanges at rear of casing.
Provide back panels.
Access
Ensure front covers are easily removed for cleaning and access to control and isolating valves.
Finish
Degrease and protect against rusting and provide corrosion protection by phosphating followed by powder coating with epoxy polyester unless otherwise indicated.
Heating elements
Materials
Finned tubes
Copper.
Fins
Aluminium.
Headers
Copper
Connections
Screwed female to relevant part of BS EN 10226 terminating within casing.
Air cock
Fit an air cock on flow connection with the air cock terminating through side of the casing, or behind front grille.
Grilles
Linear grilles to manufacturers' standard, unless otherwise indicated Ensure grilles are pencil proof.
Control Damper
Provide a control damper regulated by a knob on outside of casing with damper position clearly marked.
Testing
Pressure test at not less than 7 bar (gauge) or one and a half times maximum working pressure whichever is greater.
Thermal output and pressure drop testing / rating to be in accordance with BS EN 442-2.
Accessories
Feet to conceal rising pipes when unit fed from below.

310.080 FAN CONVECTOR HEATERS: (T31)
Duty as scheduled.
Standards
Ensure fan assisted convectors equipped with fans to increase the convective thermal output are manufactured in accordance with BS EN 16430-1 and tested/rated for thermal output in accordance with BS EN 16430-2
Ensure fan convector heaters (fan coil units) are rated in accordance with all relevant parts of BS 4856 depending on type specified.
Arrangement
As scheduled
Casing.
Construct casing from rigid heavy gauge sheet steel, strengthened to prevent drumming, with no sharp edges for safety. Support heating element from casing and ensure casing prevents air by-passing. Fit foam plastic strips to flanges at rear of casing. Provide back panels.

Internal lining
Line internal casing surfaces with fire retardant acoustic absorption material, free from surface erosion.

Access
Provide an easily removable panel to give access to fan, motor and filter.
Finish

Degrease and protect against rusting and provide corrosion protection by phosphating followed by powder coating with epoxy polyester unless otherwise indicated.
Heating elements
Materials
Finned tubes
Copper.
Fins
Aluminium.
Headers
Copper
Connections
Screwed female to relevant part of BS EN 10226, terminating within casing.
Air cock
Fit an air cock on flow connection with the air cock terminating through side of casing, or behind front grille.
Fan
Crossflow centrifugal with EC motor or double inlet, double width centrifugal type, dynamically and statically balanced, suitable for high efficiency and quiet running as scheduled.
Motor
Electronically commutated (EC) with infinitely variable speed control unless scheduled otherwise.
Vibration isolation
Isolate motor/fan assembly from casing by anti-vibration mountings.
Filter
Removable, washable type.
Grilles
Linear grilles to manufacturer's standard, unless otherwise indicated. Ensure grilles are pencil proof.
Controls
Pre-wired sensor / controls arranged as described in the controls drawings and scheduled in W60
Testing
Pressure test at not less than 7 bar (gauge) or one and a half times maximum working pressure whichever is greater.
Accessories
Mounting brackets

310.082 TRENCH HEATING: (T31)
Duty and type as scheduled.
Standards
Ensure trench heaters (convectors) are manufactured to BS EN 16430-1 and tested/rated for thermal output in accordance with BS EN 16430-2.
Sound power levels to be measured in accordance with BS EN ISO 3744
Electrical supply to BS EN 60038
Details – unless scheduled otherwise
Fan / motor type
Crossflow with electrically commutated (EU) motor with infinitely variable speed control unless scheduled otherwise.
Casing
Construct casing from rigid heavy gauge galvanised sheet steel, strengthened to prevent drumming, with no sharp edges for safety. Support heat exchanger from casing and ensure casing prevents air by-passing.
Casing minimum thickness - 1.2mm
Finish -Manufacturer's standard unless scheduled otherwise.
Grilles
Anodised aluminium roll-up linear grille to manufacturer's standard.
Stainless steel roll-up linear grille to manufacturer's standard.
Linear grilles to manufacturer's standard.
Ensure grilles are pencil proof.
Filter - fresh module for facade ventilation unit
Removable, washable type.
Connections
Brass compression fittings for connecting to valves terminating in casing.
Controls - fan assisted types

Provide manufacturer's standard wall-mounted digital controller with integral room temperature sensor suitable for interfacing with a BMS for alarm outputs.
Control requirements unless scheduled otherwise.
Provide facility for digital input for remote on/off control.
Unit to operate in natural convection mode with automatic operation of fan to increase output.
Electronically commutated (EC) motor with infinitely variable fan speed control to automatically adjust the fan speed depending on the room temperature.
Integrated timer program for programming day and week switching functions.
Provide manufacturer's standard wall-mounted electromechanical room thermostat and fan speed controller.
Controls - natural convection types
Provide and install in the convector casing a lock shield valve and thermostatic radiator valve with remote sensing bulb and adjuster.
Testing
Pressure test at not less than 7 bar (gauge) or one and a half times maximum working pressure, whichever is greater.
Accessories – unless scheduled otherwise provide the following:
Air vent and drain cock.
Two port LTHW control valve and actuator for on/off control.
Lockshield valve for return shut off / regulation.
Floor mounting brackets with height adjustment.

310.085 UNIT HEATERS: (T31)
Duty as schedule
Standard - Rate unit heaters in accordance with BS 4856.
Electrical details to BS 7697, single or 3 phase as scheduled
Arrangement - as schedule
Casing
Manufacturer’s standard. Construct casing from rigid heavy gauge sheet steel.
Provide access to fan and motor
Extend casing to cover motor and fan.
Position suspension cleats so that the heater will be suspended level before pipework is connected.
Fit spigot for ductwork connection as required.
Finish
Degrease and protect against rusting before application of a high quality stove primer and Stove enamel paint
Colour
Manufacturer’s standard.
Heating elements
Finned tubes
Copper.
Fins
Aluminium.
Headers
Steel.
Connections
Screwed female to relevant part of BS EN 10226 or Flanged to BS EN 1092 parts 1, 2, 3 or 4 - PN to suit fluid and working pressure.
Fan
Propeller type dynamically and statically balanced.
Motor
Totally enclosed, with sealed for life bearings requiring no
Vibration isolation
Isolate motor/fan assembly from casing by anti- vibration mountings.
Louvres
Provide adjustable discharge louvers as indicated.
Testing
Test to BS 4856, not less than 20 bar (gauge) or twice the maximum working pressure whichever is greater.

310.090 CONTINUOUS NATURAL CONVECTORS: (T31)
Standard - Ensure natural convectors are manufactured in accordance with BS EN 442-1,
thermal output and pressure drop testing/rating to be in accordance with BS EN 442-2
Duty as scheduled.
Type

Sill line convector.
Skirting convector.
Handrail convector.
as scheduled

Materials

Finned tubes
Copper.
Fins
Aluminium.

Casing

Provide back plates complete with brackets to support finned tube.

Manufacture back plates from aluminium, or mild steel.
Provide front plates manufactured from aluminium, or mild steel.

Finish

Degrease and protect against rusting before application of a high quality stove primer, unless otherwise indicated.

Outlet

As scheduled

Grille

Aluminium grille, unless otherwise indicated

Testing

Pressure test at not less than 7 bar (gauge) or one and a half times maximum working pressure whichever is greater.

Accessories

Support brackets

310.100 RADIANT PANELS (Heating or heating / cooling): (T31)

Duty as scheduled.

Standards

BS EN 14037-1 - technical specification and requirements.
BS EN 14037-2 - test methods for thermal output.
BS EN 14037-3 - rating method and evaluation of radiant thermal output.
If panels used in a changeover system to provide summer cooling, test panels constructed in accordance with BS EN 14037-1 for cooling capacity in accordance with BS EN 14037-4 and BS EN 14037-2.
Panels for security applications to be anti-ligature design and National Offender Management Service approved.

Material

Coil and Header, coil minimum diameter 20mm and header minimum diameter 32mm. Copper.
Front panel, minimum thickness 2mm. Aluminium, or Mild Steel.
All cover plates shall be manufactured of the same materials as the Radiant Panels and of the identical profile in order that when fitted they provide a smooth continuous face with the minimum gap to accommodate expansion between the panels and the cover plate, these being fixed with spring clips, magnets or set screws as necessary.

Finish

Degrease and protect against rusting before application of a high quality stove primer, unless otherwise indicated.

Insulation

Insulate back of panel with 40mm minimum thickness material with reinforced aluminium foil finish, and all edges taped to prevent fibre migration. Insulation shall be held in place by purpose made clips/fixings.

Air venting

Provide air cock for venting in unit header.

Access

Provide access panel to match front plate.

Support

Provide adjustable hangers for ceiling units and brackets for wall hung units.

310.111 RADIANT STRIP HEATING: (T31)

The radiant Strip Panels shall be aluminium construction having a 16 minimum gauge smooth aluminium face plate to the back of which shall be attached mechanically a special extrusion of such profile as to give at least 50% surface contact to the heating water copper tube. This extension shall be designed specifically for the purpose with the fixing arrangements such that it will allow differential thermal movement between the face plate movement between the face plate and extrusion without facial distortion.

A copper tube grid shall be held into the extrusion such that the tube is held in very close contact but at the same time allowing thermal movement.

The rear of the Strip Panel shall be provided with a 400mm thick fibre glass blanket which shall have all edges taped to prevent fibre migration.
The panels shall be provided with a factory finish.
Junctions between panels shall be by means of purpose made strips in order to allow expansion naturally.
Standards
BS EN 14037-1 - technical specification and requirements
BS EN 14037-2 – test methods for thermal output
BS EN 14037-3 – Rating method and evaluation of thermal output
BS EN 14037-4 – Test method for cooling capacity if used in a changeover system to provide summer cooling

310.120 TOWEL RAILS: (T31)
Duty as schedule
Arrangement
Floor mounted, Wall mounted or including radiator panel as scheduled
Connections
Integral screwed.
Air cock
Provide flush return end air cock.
Finish
Chromium plated.
Testing
Pressure test at not less than 7 bar (gauge) or one and a half times maximum working pressure whichever is greater.
Thermal output and pressure drop testing to be in accordance with BS EN 442-2.
Accessories
Wall /floor brackets.

310.130 EMBEDDED PIPE COILS :(T31)
Duty as scheduled
Supply pipe for installation in screed.
Material
Copper - BS EN 1057, R250 with brazed joints or
Steel – BSEN 10244, heavy, with welded joints or
Plastic to manufacturer's specification.
as indicated.

310.140 HEATED CEILING PANELS :(T31)
Duty as equipment schedule
Provide heated ceiling panels installed by specialist to manufacturer’s instructions.

310.150 UNDERFLOOR HEATING :(T31)
Duty and details as equipment schedule
Standards
Design, proving of thermal output, testing and installation in accordance with relevant parts of BS EN 1264
Comply with relevant parts of BS EN ISO 11855.
Pipe and fittings system
WRAS listed.
All underfloor pipework to incorporate an oxygen diffusion barrier.
Material
Crosslinked polyethylene (PE-X) BS 7291-3 or all parts of BS EN ISO 15875, Ends plain, and finish – natural
or Polybutylene (PB) BS 7291 Part 2 or all parts of BS EN ISO 15876 Ends - plain, and finish – grey
or Proprietary plastic multilayer composite system to BS EN ISO 21003
Two layers of PE-Xc to all parts of BS EN ISO 15875 with EVOH oxygen barrier to DIN 4726.
or Metal / plastic multilayer composite system to BS EN ISO 21003.
Welded aluminium forming oxygen barrier between inner and outer layers of PE-X to BS EN ISO 15875-2 or PE-RT to BS EN ISO 22391-2, oxygen barrier to DIN 4726.

310.151 HEAT INTERFACE UNIT (HIU) (Y22 2045).
General

Design, install, test and commission the units and systems into which they are installed following the guidance / recommendations in BSRIA BG62/2015 and CIBSE / CHPA CP1 for heat networks. The extent of design work is outlined in the scope of works / system description.

The HIU shall be CE marked.

Duty and detailed requirements - as scheduled

Electrical details

BSEN 60038, single phase or as scheduled

Arrangement

As scheduled

Standards

Equipment associated with hot and cold water services to comply with Water supply Regulations and have relevant WRAS approvals.

Materials / jointing

Internal interconnecting pipework in the HIU to be copper or 316 stainless steel connections shall be brazed or welded wherever possible, compression or other mechanical fittings will only be acceptable where it can be demonstrated that brazing or welding is not possible. Wherever practical, internal pipework and heat exchangers to be insulated to minimize heat losses.

Casing

Construct casing from rigid heavy gauge sheet steel. Provide label on unit to enable user to isolate the primary supplies in an emergency. Provide access to all components from the front of the unit, side access panel will not be acceptable. Ventilation openings to be provided to prevent overheating of pump motor or control components.

Finish

Degrease and protect against corrosion before application of high quality stove primer and stove enamel paint or powder coating, colour to be manufacturer's standard unless scheduled otherwise.

Connections

Screwed female to BS EN 10226 to suit fluid maximum working pressure.

Heat Exchangers

Plates to be 316 stainless steel and fouling factor of 10% to be used in sizing. Units to be pre-insulated at the manufacturers works.

Pump / Control

Glandless circulator to be Class A with variable speed control. Motors shall have a maximum Energy Efficiency Index (EEI) of 0.2, in accordance with EC directive 641/2009 and the amendment 622/2012. Pump motor to be permanent magnet type, with integral stepless control of pump speed to a minimum flow in response to closing of Thermostatic radiator or other 2 port control valves in the system. Pumps to comply with BS EN 60335-2-51 and relevant parts of BS EN 16297 for calculation of Energy Efficiency Index (EEI).

Circulators having a rated input of up to 200W to be tested in accordance with BS EN 16644 for structure and fluid borne noise.

Testing and Commissioning

HIU to be tested in accordance with BSRIA BTS 2/2015 to provide the following:

Product identification
Space heating circuit capacity
Domestic hot water production
Fluid side pressure drop on both circuits
Plate deflection in Heat exchangers
Heat loss

Hydraulic pressure testing at manufacturers works 1.5 times the maximum working pressure on primary and secondary side as scheduled.

Undertake commissioning and proving of capacity accordance with the relevant CIBSE / BSRIA codes and recommendations of the HIU manufacturer.

Where scheduled provide test data for testing to BESA UK HIU Test Regime Technical Specification to establish how the HIU will interact with a "Heat Network".

Temperature Control

Control of Domestic Hot Water flow temperature to have accuracy no greater than +/- 3ºC.

The controls shall ensure that the heat exchanger surfaces do not reach temperatures that could cause rapid scaling of the heat exchange surfaces.

Heat meter

To be part of units and record and display cumulative energy used (kWhrs), flow and return primary temperatures, instantaneous flow rate / kW. Heat meters to comply with relevant parts of BS EN 1434.

Flow sensor accuracy class as BS EN 1434-1 and Annex MI-004 of the EU Measuring Instruments Directive (MID 2014/32/EU) – class 2.

Cold water meter

To relevant parts of BS EN ISO 4064

To BS EN 14154-4 (if AFD's associated with Smart Metering required)

Accessories

Wall or floor brackets and items as scheduled.

Fixed full bore bypass in the primary heat network connections with binder points for measurement of differential pressure across the HIU.

310.160 PRESSURIZATION PLANT:

Standard

Manufacture pressure vessels for sealed hot water systems in accordance with BS EN 13831, and BS 7074 Part 1 (Domestic heating and hot water supply) or Part 2. (Low and medium temperature hot water heating systems) as applicable.

Manufacture pressure vessels for unvented hot water systems in accordance with BS 6144, and BS 7074 Part 1 (Domestic heating and hot water supply) or Part 2. (Low and medium temperature hot water heating systems) as applicable.

Duty as scheduled.

Accessories

100mm OD minimum system pressure gauge (calibrated in bar & psig)
High pressure switch.
Low pressure switch.
Safety valve
Water meter - integrating total system make-up quantity
Automatic pump changeover, with lead pump selector switch
Power 'on' indicating lamp
High pressure indicating lamp
Low pressure indicating lamp
Power isolating switch
Hand/off/auto switch
Hours run counter
Pump start frequency counter
Control equipment to comply with Health & Safety Executive Guidance Note PMS - Hot water boilers, category 'B'

Alarms

High system pressure
Low system pressure
Excessive pump start
Facility for remote monitoring of a common alarm condition

310.170 GAS / OIL FIRED HEATING PLANT – LOCAL HEATING UNITS (T42):

Refer to schedules / scope of work for project specific type / details and duties.

Direct and indirect fired self-contained heating units standards

BS EN 17082 - domestic and non-domestic gas-fired forced convection air heaters up to 300kW net heat input
BS 5990 - direct gas fired heaters rated from 330 kW up to 2 MW.
BS 5991 - indirect gas fired heaters rated up to 2 MW.
BS EN 1266 - gas-fired with nominal heat input up to 20kW based on net calorific value.
BS EN 13842 - oil fired forced convection air heaters.

Flue gas heat recovery

Type - Plate heat exchanger performance tested in accordance with BS EN 308

Gas fired space heaters standards

BS EN 14829 - independent gas-fired flueless space heaters for nominal heat input not exceeding 6kW.
BS EN 1266 - gas fired convection heaters up to 20kW.
BS EN 449 - LPG domestic flueless space heaters for nominal heat input not exceeding 4.2kW.
BS 5871-1 - gas fires, convector heaters and heating stoves.
BS 5871-2 - inset live fuel effect gas fires of heat input not exceeding 15kW, and fire/back boilers.
BS 5871-3 - decorative fuel effect gas appliances of heat input not exceeding 20kW.
BS 5871-4 - independent gas-fired flueless fires, convector heaters and heating stoves of nominal input not exceeding 6kW.

Gas radiant heater standards

Radiant tube heater incorporating a single burner to BS EN 416 where the supply of combustion air and/or the evacuation of products of combustion is by mechanical means located upstream of the draught diverter if fitted.

Radiant tube heater system incorporating multiple tube heater segments to BS EN 416 where the supply of combustion air and/or the evacuation of products of combustion is by mechanical means.

Radiant strip heaters incorporating a single burner to BS EN 17175, where supply of combustion air and/or evacuation of products of combustion is by mechanical means.

Multi-burner continuous radiant tube heater systems to BS EN 17175, where supply of combustion air and/or evacuation of products of combustion is by mechanical means.

Overhead luminous radiant heaters to BS EN 419

Type A appliance without a fan

Type A appliance with a fan upstream of the combustion chamber / heat exchanger

BS EN 14543 - LPG flueless radiant parasol patio heaters.

Flues to BS EN 1856-1 (tested to BS EN 1859) installed in accordance with BS EN 15287-1 and the unit manufacturers recommendations

320.000 WORKMANSHIP (T31 / T42)

320.010 INSTALLATION (T31 320.010 & T42 300.050, 310.010, 310.020, and 310.030):

Install in accordance with manufacturer's recommendations to give a neat appearance, with supports out of view where possible.

Ensure equipment is firmly fixed and level.

Install domestic systems with heat requirements up to a total of 50kW to BS EN 14336.

Installation / ventilation requirements for local gas / oil fired heaters

Install space heaters in accordance with manufacturer's recommendations.

Install gas radiant heaters in accordance with BS 6896

Install and commission gas fired air heaters of rated heat input not exceeding 2MW in accordance with BS 6230 and manufacturer's instructions.

Install and commission gas-fired air heaters of rated heat input not exceeding 70kW in accordance with BS 5864 and manufacturer's instructions.

Install and commission oil fired air heaters of rated output not exceeding 45kW in accordance with BS 5410-1 and manufacturer's instructions.

Install and commission air heaters for liquid fuel firing installations for non-domestic buildings and buildings containing multiple separate dwellings in accordance with BS 5410-2 and manufacturer's instructions.

Install unit flue and flue connection from unit in accordance with manufacturer's instructions and recommendations.

The heater manufacturers shall install and commission the flues.

Install flue in accordance with BS EN 15287-1.

Minimise the number of joints, do not locate joints in depth of floors. Install with any sockets facing upwards. Fill joints with approved jointing compound to give gas tight seal.

Install oil storage tank in accordance with BS 5410-2 and BS 799-5

Comply with BS 6896, BS EN 13410, BS 6230 or relevant part of BS 5410 depending on heater type, application and fuel, for ventilation / supply of combustion air.

320.020 BUILDERSWORK:

Mark out positions for battens fixed by others, when fixing equipment to stud walling.

320.030 SECOND FIX:

Allow for removal and second fix of all radiators.

320.040 ISOLATION:

Fit an isolating valve on flow and a regulating valve on return unless otherwise indicated.

320.051 EMBEDDED PIPE COILS & UNDERFLOOR HEATING INSTALLATION:

For plastic pipe coils embedded in screed, comply with manufacturer's instructions for installation. Lay insulation and pipework on floor slab and test prior to screeding. Protect against damage to pipework before screeding is carried out. Install panels at depth and in position shown on drawings.

Install in accordance with manufacturer's instructions and BS EN 1264-4 or BS EN ISO 11855-5, the piping system manufacturer's recommendations and comply with BSRIA BG 4/2011 for the general installation process, commissioning, balancing and start-up.

320.070 PRESSURISATION UNIT INSTALLATION:

Install pressurization unit and ancillary equipment in accordance with manufacturer's recommendations including safety valves if not part of the packaged equipment. .

Install expansion vessels and ancillary equipment for low and medium temperature hot water heating systems in accordance with BS 7074 Part 2.

Install expansion vessels and ancillary equipment for domestic heating in accordance with BS 7074 Part 1.

Install double check valves on quick fill connections.

10000 Based on NES:

T20 Dec 19
T30 Dec 04
T31 Dec 19
T42 Dec 19

Incorporating U60

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide individual and locally controlled cooling (or cooling and heating) to the areas listed in the scope of works, using units located within the spaces requiring a cooled atmosphere.

100.020 DESIGN PARAMETERS / STANDARDS
See Schedule of Common Design Criteria.
Refrigerants to have an Ozone depletion Potential (ODP) of Zero.
All components of the refrigeration system to be designed and installed to the requirements of BS EN ISO 12100, BS EN 378 Parts 1-4 - Refrigeration systems and heat pumps – Safety and Environmental requirements, BS EN 12693 (Safety and environmental requirements of refrigerating systems and heat pumps) and BS EN ISO 4126-1.
Comply with BS EN 14825 for testing and rating at part load conditions and calculation of seasonal performance.
The F-Gas Regulations 2015 as amended and relevant DEFRA guidance documents
The Pressure Systems Regulations, The Pressure Equipment Regulations 1999.
The latest edition of the relevant Institute of Refrigeration (IOR) Safety Code of Practice for refrigerant used in the installation.
The IOR Code of Practice for the Minimisation of Refrigerant Emissions from Refrigerating Systems
Systems to be designed to achieve a refrigerant leakage emission of no greater than 1% per year.
The Non Domestic Building Services Compliance Guide referred to in ADL1 and ADL2A/B of the latest edition of Part L of the Building Regulations:

PART 3 SPECIFICATION CLAUSES SPECIFIC TO T70

300.000 PRODUCTS/MATERIALS
See Scope of Works and Schedules
Electrical supply to BS EN 60038

300.001 PRESSURE EQUIPMENT DIRECTIVE/PRESSURE EQUIPMENT REGULATIONS:
All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 2014/68/EU, implemented in the UK through the Pressure Equipment (Amendment) Regulations 2015 and The Pressure Equipment (Safety) Regulations 2016, must be tested by the manufacturers, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.

Only relevant equipment and assemblies certified as compliant will be permitted under this specification, and any substitution put forward must also be compliant with the Directive.

300.015 REFRIGERANTS:
CFC and HCFC refrigerants are prohibited and must not be used.

On applicable projects and detailed elsewhere, comply with BREEAM requirements below to suit the type of construction and scheme.
BREEAM New Construction 2018 Requirement
Comply with Issue ID Pol 01 Impact of Refrigerants.
BREEAM Refurbishment and fit-out 2014 requirement
Comply with Issue ID Pol 01 Impact of Refrigerants.

300.017 ECODESIGN / EER REQUIREMENTS FOR AIR CONDITIONERS:
Equipment to be in accordance with The Energy Related Products Regulations 2010 as amended
Fans incorporated into plant with electric input between 125W and 500kW to comply with EU Regulation 327/2011.
Units with a rated capacity of up to 12kW to comply with EU Regulation 206/2012.
Other plant to comply with EU Regulation 2016/2281 for seasonal space cooling energy efficiency and product information / instruction manuals.
The full load (cooling) Energy Efficiency Ratio (EER) of plant shall be as detailed elsewhere in this specification but shall not be less than the minimum values given in the latest edition of the appropriate Non-Domestic Building Services Compliance Guide.

300.021 COOLING / HEAT PUMP UNIT:

Standards

Relevant parts of BS EN 378, all relevant parts of BS EN 14511 and BS EN ISO 4126-1.
BS EN 12693 for safety and environmental requirements of positive displacement refrigerant compressors.
Comply with BS EN 14825 for testing and rating at part load conditions and calculation of seasonal performance.
BS EN 60335-2-40 for safety of air-conditioners and heat pumps.
Acoustic - determine sound power levels in accordance with BS EN 12102-1

On applicable projects as described in scope of works comply with international standards.
BS ISO 5151 for non-ducted air-cooled air conditioners and air-to-air heat pumps.
BS ISO 15042 for multi-split systems, modular multi-split systems and modular heat recovery multi-split systems.
Relevant parts of BS ISO 16358 for testing and calculation of seasonal performance factors

Casing

Manufacture casing from galvanized sheet steel in steel frame. Seal joints to prevent air leakage. Line casing with thermal and acoustic insulation.
Manufacturer's standard finish.

Access

Provide access to components requiring regular maintenance via access panels with special locks or hinged access doors.

Cooling unit components

Fans

Provide fan, motor and drive assembly mounted on a base frame. Isolate base frame to prevent transmission of vibration to unit.
Supply double inlet, double width forward curved centrifugal fans.
Drive fans from motor by multiple vee belts and pulleys keyed to shaft. Provide means of tensioning belt drive via sliding base.

Cooling section

Provide cooling coil manufactured from copper tube with aluminium fins.
Provide condensate drain pan with drain connection.

Filters

Provide return air filter - BS EN ISO 16890 coarse 50% unless scheduled otherwise.

Accessories

Condensate pump wired to disable the unit in the event of a pump failure

300.030 REMOTE AIR COOLED CONDENSING UNIT:

Provide a condensing unit incorporating hermetic compressor, condenser coil and fan or provide a condensing unit incorporating condenser coil and fan as scheduled.

Where the compressor is incorporated as part of the unit provide compressor complete with crankcase heater, suction and delivery valves, service connections and high and low pressure safety switches.

Standards:

Relevant parts of BS EN 378 & BS EN 14511 and BS EN ISO 4126-1
BS EN 12693 for safety and environmental requirements of positive displacement refrigerant compressors.
Performance testing / rating conditions in accordance with BS EN 13771-2 and BS EN 13215.
Acoustic - determine sound power levels in accordance with BS EN 12102-1

Casing - Provide a weatherproof casing.

Finish - Manufacturer's standard unless otherwise indicated.

300.040 INTEGRAL COMPRESSOR UNIT:

Where specified, supply a fully hermetic compressor and fan mounted within the casing of the air conditioning unit. Provide compressor complete with suction and delivery valves, service connections and high and low pressure switches. Mount compressor on anti-vibration mountings to prevent the transmission of vibration. Fit a crankcase heater to prevent migration of refrigerant.

Ensure unit complies with BS EN 378, BS EN 12693, BS EN 14511and BS EN ISO 4126-1.

Comply with BS EN 14825 for testing and rating at part load conditions and calculation of seasonal performance.

300.046 CONTROL SYSTEM:

Refer to schedules and W60 for details
Locate room thermostats in position representative of ambient conditions on a north facing wall out of direct sunlight.
Configure controls to ensure that cooling and heating cannot operate simultaneously. Ensure heating is off before cooling operates.
Provide a 24 hour/7 day timer.

300.053 WINDOW/WALL MOUNTED AIR CONDITIONING UNIT (wasU60:300.020):
Provide packaged air conditioning unit complete with integral condenser.
Standards BS EN 378, BS EN 12693, BS EN810, BS EN14511, BS EN 60355-2-40 and BS EN ISO 4126-1
Acoustic - determine sound power levels in accordance with BS EN 12102-1
Comply with BS EN 14825 for testing and rating at part load conditions and calculation of seasonal performance.
Access
Provide access to filter, fan and motor.

300.061 REFRIGERANT PIPEWORK
Material
Refrigerant quality copper to BS EN 12735-1, fully annealed and internally degreased and cleaned.
Tubes for equipment to BS EN 12735-2.
Jointing
Do not used screwed joints in pipelines, except for connection to equipment.
Brazing - comply with British Refrigeration Association (BRA): Specification & Procedures for Manual Torch Brazing and Brazer Assessment
Insulation
On internal pipelines, insulate suction pipe from evaporator to compressor.
On external pipelines, insulate both suction and discharge pipes and protect from solar radiation where pipework is not otherwise shielded.

300.062 REFRIGERANT PIPEWORK INSTALLATION [U60:320.020]:
Comply with relevant Institute of Refrigeration (IOR) Safety Code of Practice for refrigerant used in the installation.

Arrange all exposed pipe runs to present neat appearance, parallel with other pipe or service runs and building structure, subject to gradients for draining or venting.

Ensure all vertical pipes are plumb or follow building line.
Support all pipework pipework and controls cabling throughout their length using cable tray, firmly fixed to the building fabric.
Space pipe runs in relation to one another, other services runs and building structure, allow for specified thickness of thermal insulation and ensure adequate space for access to pipe joints, etc.
Take precautions to prevent the discharge of refrigerant gases to atmosphere.
All refrigerant pipework insulation at low level or in locations where mechanical damage could occur or which could be damaged by UV radiation shall be suitably protected.

Where regulations permit supply the split system fully charged with refrigerant and with an oil charge sufficient for the effective and efficient operation of the compressor.

Ensure the completed installation is installed in line with manufacturer recommendations. Carry out strength and leak pressure tests on completion of installation. Evacuate the system and ensure that the system holds a vacuum for a period of 12 hours prior to charging with refrigerant. Submit a method statement to the Engineer for review and comment prior to pressure testing, evacuating or charging.

300.064 DRAINAGE PIPEWORK [U60 300.120]
Provide condensate drainage pipework from all units that could have wet coils to drain.
Refer to schedules and / or scope of work for details, extent of pumping and type of system.
Copper tube to BS EN 1057, fittings solder, Install tees rather than bends to allow cleaning.
Or unplasticised PVC to relevant parts of BS EN ISO 1452.
Provide tundish and air break at units.
Provide trap - depth minimum 1.5 times negative pressure on inlet and 0.5 times negative pressure at discharge
Provide an air break between trap outlet and drainage system. Pipe each trap to drain via a tundish or pipe each trap separately to discharge over a gully to prevent the potential of cross contamination between AHU's.

310.000 WORKMANSHIP

310.010 INSTALLATION:
Install equipment in accordance with manufacturer's recommendations.
Comply with relevant Institute of Refrigeration (IOR) Safety Code of Practice for refrigerant used in the installation.

10000 Based on NES T70 text Dec 19 and NES T14 / U60 TEXT June 18

U10 – Ventilation Supply/Extract

Incorporating U11 (toilet ventilation), U12 (kitchen ventilation), U13 (car park ventilation) T40 (Warm air heating from central ventilation plant)

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES AND REGULATIONS / STANDARDS

To provide an air movement system to ventilate the spaces listed and to remove vitiated air where indicated.

To temper and filter the air where indicated or provide space heating from central ventilation plant (refer to Y40 for air handing units details)
Refer to clause W60 320.101 for control panel design, construction and installation, W60 320.091 for cabinets for BMS equipment design and construction and W60 320.102 for fireman's override fan control panel.

Comply with Building Regulations Approved Document F1 (England and Wales) or Building Standards Domestic or Non Domestic Technical Handbooks, Section 3.14 (Scotland) or Building Regulations Technical Booklet K (Northern Ireland).

Comply, as detailed in the scope of works and schedules (including Y40sch and A13sch), with the requirements of BS EN 16798-3 and additional guidance in PD CEN/TR 16798-4 to achieve the specified category of supply air (SUP) with defined category of outdoor air (ODA).

Comply with BS EN 15423: Ventilation for buildings. Fire precautions for air distribution systems in buildings.

Naturally ventilated / mixed mode buildings. (NES U10 300.005 – 300.015)

Comply with the following unless detailed otherwise in the project specific scope of works.

Any design work detailed in the project specific scope of works for natural / mixed mode ventilation to comply with Code of Practice BS 5925.

Calculations for determination of air flow rates including infiltration to be in accordance with BS EN 16798-7 and energy losses due to ventilation to be in accordance with BS EN 16798-5-1 and BS EN 16798-5-2.

Use Computational Fluid Dynamics (CFD) to predict airflows and temperatures in 3-dimensions in the building and within the natural ventilation devices.

Predict by dynamic simulation whether summertime overheating is likely to occur.

Unless detailed otherwise in the scope of works, the building shall conform to IEQ Category II (Medium level of expectation for indoor environmental quality) in BS EN 16798-1

Employ a specialist or the ventilation terminal unit manufacturer to develop the concept design and the tender stage thermal model and undertake dynamic thermal modelling calculations using manufacturer's data for the selected ventilation terminals in order to ascertain the optimum size, location and number of terminals required.

Kitchen ventilation (U12)

Comply with the design, construction, testing and commissioning requirements of BESA DW/172 appropriate to the scope of works / system description or relevant parts of BS EN 16282 appropriate to the scope of works / system description and schedules.

Car park ventilation systems (U13)

Comply with the requirements of BS 9999, BS 7346-4 or BS 7346-5, BS 7346-7 and BS 7364-8 and Building Regulations Approved Document B (Fire Safety) for car park ventilation in order to limit concentrations of carbon monoxide (CO) and other vehicle emissions in the day-to-day use of car parks and to remove smoke and heat in the event of a fire.

Ensure wiring is suitable for high temperatures to provide a maintained supply.

Comply with BS 7671 (IET Wiring Regulations) and provide power supplies in accordance with BS EN 12101-10.

The cables selected for power and control wiring for the installation shall be fire-resistant meeting the requirements of BS 8519.

Schools

Where applicable, comply with the requirements of the latest version of Building Bulletin 101 Ventilation of School Buildings for school ventilation and baseline designs and strategies for schools, including for the Priority School Building Programme (PSBP) where appropriate

Offices

Where applicable, comply with the top of the range recommended in the British Council for Offices Guide to Best Practice in the Specification of Offices.

Healthcare buildings

Where applicable, comply with the requirements of HTM 03-01 Specialised ventilation for healthcare premises (England, Wales and Northern Ireland) SHTM 03-01 Ventilation for Healthcare premises Part A: Design and Validation (Scotland) for Clinical areas with controlled environmental conditions.

General

Undertake checks and tests in order to verify the fitness for purpose of the installed systems prior to handover in accordance with BS EN 12599.

Refer to Y30sch1 for each ventilation systems cleanliness quality class to BS EN 15780 and PDI level to BESA TR/19

For residential ventilation comply with BS EN 13142 for performance characteristics. Performance test ventilation components/products in accordance with relevant parts of BS EN 13141.

100.020 DESIGN PARAMETERS / REQUIREMENTS

General

See Schedule of Common Design Criteria / clause 100.010.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO U10

300.011 TOILET EXTRACT UNIT (U11 300.010)

Electrical safety to BS EN 60335-2-80.
Motor - Electrical supply to BS EN 60038, type as scheduled
Access - provide access via removable panel.
Controls - On/off with auto changeover.
Accessories

Backdraught dampers.
Anti-vibration mounts.

Testing

Where fans approved under CAME scheme are used provide certified data for type.
Where fans are not approved under CAME scheme provide results of aerodynamic performance tests in accordance with BS EN ISO 5801; noise tests in accordance with BS EN ISO 5136, BS ISO 13347 parts 1-4; and fan vibration tests in accordance with BS ISO 14695.

300.015 ECODESIGN REQUIREMENTS FOR AIR HEATING PLANT: (T40)

Equipment to be in accordance with The Energy Related Products Regulations 2010 as amended.
Plant to comply with EU Regulation 2016/2281, including Seasonal Space Heating Energy Efficiency (SHEE) and product information / instruction manuals information on disassembly, recycling and/or disposal.

300.020 NATURAL VENTILATION TERMINAL UNIT MANUFACTURER:

Use ventilation terminal units from a single manufacturer.
The selected ventilation terminal unit manufacturer shall undertake the following

Provide structural loadings and installation details.
Produce installation and record drawings for all ventilation terminals, co-ordinated with the architect and structural engineers' details.
The supply, installation, testing and initial commissioning of all ventilation terminals and all associated controls that make up the ventilation systems in the building.
Seasonal commissioning to prove the installed system and facilities meet the design criteria and users' requirements.

300.040 INTEGRATION, CONTROL AND MONITORING: (U13 car park ventilation)
Provide an integrated system as detailed in the scope of works / schedules.
Equipment to be controlled / monitored should interface with BMS and fire alarm system as described in the scope of works via:
Local outstations and/or local control panels
Supervisory control and data acquisition system via:
Local outstations / control panels
Fire detection and alarm system:
Ensure interfaces to fire detection and alarm system comply with the requirements of the relevant parts of BS 5839 and BS 7273
Ensure relevant equipment complies with BS EN 50130-4.

300.050 SOFTWARE: (U13 car park ventilation)
Obtain on behalf of the end users all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Provide documentation for application software in accordance with BS ISO/IEC 26513 and BS ISO/IEC 26514.
Ensure that, as far as practicable, all software is commercially available off-the-shelf.
Ensure that any programmable configuration, customisation, and bespoke software, is developed, tested and commissioned using relevant processes and procedures complying with BS ISO/IEC/IEEE 12207 or BS ISO/IEC/IEEE 15288 supported by a quality management system meeting the requirements of BS EN ISO 9001.

310.000 PRODUCTS/MATERIALS
Provide system components as indicated on drawings and schedules

Natural ventilation (NES U10: 310.010 – 310.040)
Where natural ventilation terminal units include automatic controls, a manual override should be fitted to allow short-term adjustment during unexpected weather conditions.
All natural ventilation terminals to include insect screen and weather protection.
Louvres to comply with Y46 and be tested in accordance with BS EN 13030.
Air transfer devices and trickle ventilators to comply with BS EN 13141-1 for performance testing of externally and internally mounted air transfer devices and BS 6375-1 for performance for weather tightness.
Test local wall ventilators and trickle ventilators to demonstrate they comply with BS EN 1026 and BS EN 1027 for air permeability and water tightness.
Air permeability 0.25m3/hr at 50Pa in closed position unless detailed otherwise in scope of work
Water tightness - no leakage at 1000Pa in closed position unless detailed otherwise in scope of work
Sound reduction – weighted element normalised difference to be rated in accordance with BS EN ISO 717-1. Refer to scope of works for project specific requirements.

310.005 MAIN CAR PARK EXTRACT FANS (U13 310.005):
The facilities shall be designed in accordance with code of practice BS 7346-7.
Details of fans are given in work section Y41 and schedules.
Details of controls and BMS requirements and interfaces with main car park extract fans and impulse fans (where installed) are given in the scope of works or work section W60.
Testing
Test aerodynamic performance to BS EN ISO 5801
Temperature/time classification to BS EN 12101-3
300°C for not less than 60 minutes unless scheduled otherwise
Power supplies
Comply with BS 7671 and BS EN 12101-10

Where fans are not approved under CAME scheme provide results of aerodynamic performance tests in accordance with BS ISO 14695, BS 848-6

310.006 CAR PARK MAKE UP AIR HANDLING SYSTEM (U13.310.006):
Refer to scope of works / schedules and work section Y40 for details of air handling units.
Control and BMS requirements and interfaces with main car park extract fans and impulse fans (where installed) are given in the scope of works or work section W60.

310.012 CAR PARK VENTILATION SYSTEM AND IMPULSE JET CAR PARK VENTILATION

UNITS (U13 300.001, 300.010, 300.015 & 310. 010)

Refer to schedules for duties / details.

Use a specialist to manufacture, supply and install and commission the car parking ventilation equipment and associated control system to operate the jet fans and associated main car park extract fans.

Where scheduled use a specialist to undertake the detailed design of the system and carry out a detailed CFD study of the car park ventilation system and prepare and submit the CFD analysis to the approving authority, in accordance with the Smoke Control Association / HEVAC Guide - CFD Modelling Guide for Car Park Ventilation Systems. The system shall be designed in accordance with the functional and calculation methods described in BS 7346-7 and BS 7346-8.

Standards

Comply with BS 9999, BS 12101-3, BS 7346-7 and BS 7346-8

Comply with BS 7671 and provide power supplies in accordance with BS EN 12101-10.

The cables selected for power and control wiring for the installation shall be fire-resistant meeting the requirements of BS 8519.

Operation

Sequential impulse fan and main extract fan operation on demand from bespoke control system.

Materials

Polyester powder coated or Manufacturer's standard.

Electrical safety to BS EN 60335-2-80.

Motor

Electrical supply to BS EN 60038

Accessories

Directional outlet diffuser.

Safety inlet guard

Controls - Provide speed controller to match fan.

Testing

Jet fans performance test data in accordance with BS EN ISO 13350.

Temperature/Time classification to BS EN 12101-3: 300°C for not less than 60 minutes unless scheduled otherwise.

Provide results of fan vibration tests in accordance with BS ISO 14695, BS 848-6.

310.015 DUCTWORK SYSTEM FOR CAR PARK VENTILATION (U13 310.015):

All smoke control duct sections should comply with BS EN 12101-7, tested to the requirements of the relevant parts of BS EN 1366 and classified in accordance with BS EN 13501-4.

Smoke control dampers should comply with BS EN 12101-8, tested to BS EN 1366-10 and classified in accordance with BS EN 13501-4.

Provide test classification report using BS EN 13501-4 nomenclature from a UKAS accredited certification body.

The design and selection of the system shall comply with the recommendations of BS 7436-7: Annex A.

Refer to schedule Y30 schedules for project specific details

310.016 KITCHEN VENTILATION CEILINGS (U12 310.030):

Type – refer to scope of works / drawings

Standards

BESA DW/172 and BS EN 16282-3 for design, construction and safety requirements

Details – refer to scope of works / drawings

310.017 TREATMENT OF AEROSOLS/POLLUTION IN KITCHEN EXHAUST SYSTEMS (U12 310.032):

Type – refer to scope of works / drawings

Standards

BS EN 16282-8 for design, construction and safety requirements

Details – refer to scope of works / drawings

310.031 DUCTWORK FOR KITCHEN VENTILATION SYSTEMS (U12 310.030)

For normal applications supply and install ductwork associated with kitchen canopies in accordance with DW144 as detailed in DW 172 and clause Y30.2065

Kitchen extract ductwork to be fire resisting as schedule Y30sch5 and clauses Y30.2110C and 2110D or Y30.2110F or as described in the scope of works.

Where existing systems require inspection and cleaning prior to modification, employ a specialist to undertake the following works approved in accordance with Loss Prevention Standard LPS 2084:

Inspect and clean ductwork that may be contaminated with combustible deposits.

Make recommendations for access improvements to any areas where there is currently limited access making cleaning / maintenance impractical.

When total grease tightness is required Supply and install grease tight ductwork in accordance withDW172

Access doors for cleaning (with grease tight gaskets) shall be installed at every bend and connection and at every 3m on straight lengths of ductwork on all kitchen extract systems.

Material

1.2mm stainless steel.

or 1.6mm zintec.

Supply and install ductwork to extract steam from dishwasher and potwashing machines in accordance with DW172.

Refer to Y30 schedules and/or U10 scope of work for project specific requirements.

310.032 GROUND –AIR HEAT EXCHANGE SYSTEM - PIPEWORK / DUCTS (NES 230.085)

Refer to schedule U10sch3 for project specific requirements.

Material

Polypropylene to BS EN 1852 and DIN 16962 or HDPE to DIN 16961 or DIN 8074 and 8075 with ring stiffness to BS EN ISO 9969

Or Concrete to DIN 4032 and DIN 4035

All materials installed in the ground to be non-toxic and non-corroding in accordance with VDI 4640 Parts 1 and 4.

The materials shall have a smooth – surface interior, not attract dust, be non-hygroscopic and air tight. Corrugated pipes are not acceptable.

The complete system including all joints to be radon proof.

Installation

Install at a minimum fall of 1:50 towards the building / condensate removal facility

310.041 KITCHEN VENTILATION GAS SAFETY INTERLOCK FACILITIES (U12)

Provide an interlock between all kitchen gas appliances supply and extract ventilation to kitchens, such that the ventilation system operation must be proved before the gas appliance can be used in accordance with BS 6173. If an automatic electric isolation valve system is installed in the gas supply to the kitchen then the ventilation system shall also be interlocked with this system.

Comply with IGEM/UP/19 for the design, and application of interlock devices used within commercial and industrial applications including catering.

Scope to include control panel, pressure switch or sensing device, gas isolation control valve and all interconnecting power and control wiring.

Install interlock system in accordance with the manufacturer's recommendations.

Provide the following interlocks unless detailed otherwise in the scope of works or schedules:

- Primary interlock between ventilation system and appliances using differential pressure switch to shut gas isolation valve and lock out appliance on low pressure failure.
- Primary interlock between ventilation system and appliances by monitoring power used by fans to shut automatic gas isolation valve and lock out appliance on low absorbed power.
- Secondary interlock to shut gas isolation valve and lock out appliance on sensing high CO2.
- Secondary interlock to shut gas isolation valve and lock out appliances on fan failure or trip.
- Interlock with fire detection system
- Interlock with gas detection system
- BMS interface

Where appliances do not have flame failure devices provide a pipework integrity system (formerly referred to as weep by-pass system) in accordance with Appendix 12 in IGEM/UP/2 Edition 3.

320.000 WORKMANSHIP

320.010A INSTALLATION AND COMMISSIONING (NATURAL / MIXED MODE BUILDINGS/ RESIDENTIAL):

For mechanical ventilation systems refer to the appropriate specification sections including Y51 for testing and commissioning of mechanical services.

Provide a method statement for the installation and commissioning of the ventilation facilities and controls.

The following notes are associated with natural and mixed mode ventilation systems.

The installer shall undertake a pre-installation survey prior to delivery of ventilation terminals to check all site dimensions and access facilities. A report shall be produced with results of survey and any remedial work required to the terminals shall be carried out before delivery to site.

The ventilation terminal unit manufacturer shall install and commission the ventilation terminal units and all associated controls or employ a certified, trained and vetted installer to undertake the work on behalf of the manufacturer.
Weathering details for all terminals to be agreed with the architect prior to installation.
Installation of all equipment to be installed in accordance with the manufacturer's instructions.
Commissioning should be undertaken by a control specialist to set the natural ventilation system up to recognise seasonal conditions. These should be set to meet the requirements of the building and its location.
Demonstrate the performance of residential ventilation systems through performance testing and installation checks in accordance with BS EN 14134.
Comply with the best practice requirements of BSRIA BG 46/2015 Domestic Ventilation Systems - A guide to measuring air flow rates. For measurement of air flow rates use the unconditional method.

320.011 EQUIPMENT INSTALLATION
Install equipment in accordance with manufacturer's recommendations.
Install and commission LEV systems in accordance with the latest edition of Health and Safety Executive HSG258.

320.012 PROTECTION (U13 car park ventilation)
Protect all car park duct droppers with 6mm bands 50mm wide. These shall be positioned at 300mm, 600mm and 1200mm affl, and shall be GAM. There shall be a 25mm air gap between the outside of the duct and the protective band.

320.020 KITCHEN CANOPY AND INSTALLATION (U12)
Design, manufacture, supply and install kitchen canopies in accordance with DW 172
Electricity safety of either complete electric hoods or hoods supplied as separate parts which when assembled form a complete working hood, incorporating fan to comply with BS EN 60335-2-99.

320.020A SYSTEM PROOVING / POST COMMISSIONING (NATURAL / MIXED MODE BUILDINGS:
Revisit site 3 months after handover and check all terminal units and associated controls for operation in accordance with the design intent.
Undertake seasonal commissioning as defined elsewhere in this specification.
Visit site 12 months after handover to obtain user feedback from periods of high/low occupancy and during all seasons and adjust controls/fine tune the systems as necessary to improve performance if required. Report findings to the designer and building owner/operator and amend the O&M manuals, Building Log Book and Building User Manual.
Where required comply with the 3 year aftercare requirements of Soft Landings.

320.022 INSTALLATION OF CAR PARK SMOKE CONTROL SYSTEM (U13 320.010):
Install, commission and test the car park smoke control equipment in accordance with manufacturer's instructions, the requirements of the approving authority and BS 7346 Parts 7&8.
In addition to the general requirements for operation and maintenance documentation elsewhere in this specification comply with the requirements of BS 7346 Parts 7&8.

Commissioning should be undertaken by a control specialist to set the natural ventilation system up to recognise seasonal conditions. These should be set to meet the requirements of the building and its location.

320.023 QUALITY CONTROL (U13 320.020):
Record all commissioning measurements and tests and site modifications to hardware or software, and revise operating and maintenance instructions accordingly.
Manage configuration of software settings, data and design, in accordance with an appropriate Configuration Management Plan (CMP), complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC/IEEE12207 and BS ISO/IEC/IEEE 15288.
Provide configuration details along with the operation and maintenance manual on hand-over.
Manage information security of systems, software and data during design, implementation and commissioning in line with BS EN ISO/IEC 27001.

10000 Based on NES U10 TEXT Dec 19
U11 TEXT June 17
U12 TEXT Dec 18
U13 TEXT Dec 19

U14 – Smoke and Heat Control

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide an air system for removing and controlling the build-up of smoke arising from a fire, and to assist in securing the safety of personnel and in maintaining safe escape routes.
Comply with BS EN 15423 for fire precautions for air distribution systems in buildings.

100.020 DESIGN PARAMETERS
See Schedule of Common Design Criteria.
BS 7346 - 4

PART 3 SPECIFICATION CLAUSES SPECIFIC TO U14

300.000 GENERAL

300.010 ELECTRICAL SUPPLY:
Ensure wiring is suitable for high temperatures to provide a maintained supply.

300.015 DESIGN:
Comply with the requirements of BS 9999.
Comply with BS 9991 for residential buildings.
Where described in the scope of works or schedules, the smoke and heat exhaust ventilation systems shall be designed in accordance with the functional and calculation methods described in BS 7346-4, for steady-state design fires or BS 7346-5 for time dependant design fires.
Where described in the scope of works or schedules, pressure differential systems (using either depressurisation or pressurisation) to limit the spread of smoke shall be designed, installed and tested in accordance with BS EN 12101-6

300.020 CONSTRUCTION NATUIRAL SMOKE AND HEAT VENTILATORS GENERALLY:
Ensure natural smoke ventilator is constructed so that when in use no flames or hot gases are deflected directly onto an adjacent structure.
Ensure materials used in the construction of the heat and smoke ventilator do not add to the fire risk of the building, nor contribute to a fire during use.
Construct ventilators from material defined in BS 476-12.

300.030 QUALITY ASSURANCE:
Ensure manufacturers are a firm of Assessed Capability to BS EN ISO 9001 and produce equipment to relevant Quality Assessment schedule.

300.040 INTEGRATION, CONTROL AND MONITORING:
Provide an integrated system as detailed in the scope of works / schedules.
Equipment to be controlled / monitored should interface with BMS and fire alarm system as described in the scope of works via:
Local outstations / control panels
Supervisory control and data acquisition system via:
Local outstations / control panels
Fire detection and alarm system:
Ensure interfaces to fire detection and alarm system comply with the requirements of BS 5839 and BS 7273.
Ensure relevant equipment complies with BS EN 50130-4.

300.050 SOFTWARE:
Obtain on behalf of the end users all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Provide documentation for application software in accordance with BS ISO/IEC 26513 and BS ISO/IEC 26514.
Ensure that, as far as practicable, all software is commercially available off-the-shelf.
Ensure that any programmable configuration, customisation, and bespoke software, is developed, tested and commissioned using relevant processes and procedures complying with BS ISO/IEC/IEEE 12207 or BS ISO/IEC/IEEE 15288 supported by a quality management system meeting the requirements of BS EN ISO 9001.

310.000 PRODUCTS/MATERIALS

310.005 GENERAL

Equipment shall be supplied complete with all necessary ancillary items.

Comply with BS 9999 or BS 9991 for residential buildings.

Comply with BS EN 15423 for fire precautions for air distribution systems in buildings.

Comply with all relevant parts of BS 7346, BS EN 12101 and BS ISO 21927-9 for control equipment / control panels.

310.021 SMOKE EXTRACT FANS, DAMPERS, DUCTS AND NATURAL VENTILATORS:

Ensure smoke extract fans and ventilators are constructed so that when in use no flames or hot gases are deflected directly onto an adjacent structure.
Ensure materials used in the construction of the smoke extract fans and ventilators do not add to the fire risk of the building, nor contribute to a fire during use.
Construct smoke extract fans and ventilators from material defined in BS 476 -4 as non-combustible. Ensure smoke extract fans and ventilators have a Class 1 spread of flame rating when tested in accordance with BS 476-7 and are classified as `does not readily sustain ignition' to BS 476-12.

Facilities shall comply with the following standards:
(Refer to schedules for details / duties)

Fans - BS EN 12101-3. Aerodynamic performance tested to BS EN ISO 5801, BS 848-1

Natural smoke and heat exhaust ventilators (roof or wall mounted, flap or louvre types) – BS EN 12101-2

Smoke and heat control duct sections – BS EN 12101-7, tested to BS EN 1366-8 or BS EN 1366-9 and classified in accordance with BS EN 13501-4

Smoke control dampers – BS EN 12101-8, tested to BS EN 1366-10 and classified in accordance with BS EN 13501-4. Provide test classification report using BS EN 13501-4 nomenclature from a UKAS accredited certification body.

Selection and installation of fire resistant power and control cable systems to BS 8519
or comply with relevant parts of BS ISO 21927

Power supply equipment to BS EN 12101-10.

310.022 SMOKE CURTAINS:

Smoke curtains shall comply with BS EN 12101-1. Control shall be provided by the curtain manufacturer to achieve a fully operational system.
Automatic smoke curtains shall comprise a fire resistant fabric on a steel roller and be powered by an internal electric, tubular geared motor.
The motor assembly shall contain the necessary gearbox, distance travel/limit switches, braking systems and drive mechanism. All working parts shall be within the roller.
Extruded aluminium closures shall be secured to the bottom edge of the curtain to assist descent, stabilise curtain movement and link multiple runs.
Fabric material shall be woven fibre to give 30min integrity at 1000°C (to BS476 Part 20). Edge gap tolerance shall be less than 30mm.

310.023 SMOKE CURTAIN CERTIFICATION:

Smoke curtain fabric, assembly and installation shall comply with:

BS EN 12101-1 or BS ISO 21927-1 Specification for smoke barriers
BS476 - 7 Class 1 Surface spread of flame
BS476 - 4 Classified as non-combustible
Building Regulations Class O

310.024 CONTROL SYSTEMS:

Equipment to comply with and be tested to BS EN 12101-10 (power supply equipment) and BS ISO 21927-9 (specification for control equipment).
Selection and installation of fire resistant power and control cable systems to BS 8519

320.000 WORKMANSHIP

320.010 INSTALLATION / COMMISSIONING:
Install and commission smoke control equipment in accordance with manufacturer's instructions and BS 7346-8.

320.020 QUALITY CONTROL:
Record all commissioning measurements and tests and site modifications to hardware or software, and revise operating and maintenance instructions accordingly.
Manage configuration of software settings, data and design, in accordance with an appropriate Configuration Management Plan (CMP), complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC 12207 and BS ISO/IEC/IEEE 15288.
Provide configuration details along with the operation and maintenance manual on hand-over.
Manage information security of systems, software and data during design, implementation and commissioning in line with BS EN ISO/IEC 27001.

10000 Based on NES U14 Text Dec 19

Incorporates V12 (public utility supply)

PART 1 SYSTEM OBJECTIVES

100.011 PERFORMANCE OBJECTIVES

To provide the distribution of low voltage electricity from the supply authority's source to the building main switchboard and from the building main switchgear panel to and including the area distribution boards, sub-distribution board, motor control centres and specific items of mechanical plant.

To provide three phase power supplies to user points.
Refer to scope of works for primary and secondary sources of power.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO V20

300.000 PRODUCTS/MATERIALS

300.012 SWITCHBOARDS, DISTRIBUTION BOARDS

Refer to Y71

300.013 CABLES and SUPPORTS

Refer to Y61 and Y63

300.014 EARTHING

Refer to W51, which incorporates Y80 clauses for earthing and bonding components.

300.015 BUSBAR TRUNKING

Refer to Y62

300.020 LV OVERHEAD LINES AND ARIEL CABLES (V12.300.020)

Provide erected poles and accessories for supporting aerial/catenary low voltage distribution cables, to suit application.

Poles

Standard BS 1990-1

Insulator fittings and pins for bare conductors

Standard BS 3288 parts 1&2. BS EN 61466 parts 1&2, BS EN 61284 and BS EN 60372

Overhead line conductors

Standard BS 7884		Copper
BS EN 61232		Aluminium clad steel
BS 215-1		Aluminium stranded
BS 215-2		Aluminium - steel reinforced
BS EN 50183		Aluminium Alloy
BS 6485	Covered conductors	

300.081 CO-ORDINATION STUDY

Where required in the scope of works, carry out a complete protection grading and setting calculation of the complete electrical distribution system, including all connected equipment. Engage an independent Chartered Engineer specialising in electrical installation design to:
Undertake and verify the calculation.
Provide fault (short circuit) calculations for the distribution system as indicated on the drawings and a protective device co-ordination study to ensure that all protective devices are co-ordinated, to achieve full discrimination (unless specified otherwise). Base the study on the actual devices and cable lengths installed.
Prepare the fault calculations in accordance with BS EN 60909 and protective device study with an approved proprietary software package, by prior approval written calculations may be used for simple networks, include complete fault calculations for each proposed source and combinations thereof including motor, generator and UPS contributions.
Present the fault calculations including the following:

General description of calculations methods, assumptions and base per unit quantities selected.

Evaluation of grading margins used.

Single line diagrams, source and electrical equipment characteristics (impedance data including X/R ratios, zero sequence impedances, inrush current characteristics, rated currents, design loads).

Calculation of peak and three phase symmetrical / asymmetrical prospective fault currents (short circuit and earth fault) at each switchboard, motor control centre and distribution board.
Typical calculations, tabulations of calculation quantities and results, verification of electrical equipment fault ratings.
Conclusions and recommendations

Carry out the protective device co-ordination study including the following:
Consideration of:
Short-circuits
Overloads
Residual currents
Possible fault currents in systems with semiconductors in accordance with Figure A53.1 of BS 7671 (IET Wiring Regulations)
Time-current co-ordination curves graphically indicating the proposed co-ordination for the system on log-log graph transparencies. Include on each sheet, a complete title and single-line diagram identifying the specific portion of the system covered.
A detailed description of each protective device (overcurrent and/or residual current) identifying its type, function, manufacturer and time current characteristics and tabulation of recommended settings.
Carry out adjustments of the protection settings to confirm that the requirements of the report, ensure that;
Selectivity is achieved throughout the network and select protective devices and settings accordingly.
electrical equipment is protected.
maximum disconnection times are achieved.
Time-current co-ordination curves graphically indicating the proposed co-ordination for the system on log-log graphs for short circuit and earth fault conditions. Include on each sheet, a complete title and single line diagram identifying the specific portion of the system covered.
A detailed description of each protective device identifying its type, function, manufacturer and time current characteristics.
Tabulation of recommended settings and operating values for each function of each device.
Include on the graphs, relay characteristics, pertinent transformer, motor and generator characteristics from the downstream HV device and including up to the largest outgoing LV circuit breaker/fuse for each final distribution board. Indicate manufacturing tolerances clearly showing the final grading margin.
The co-ordination study should demonstrate that all low voltage switchgear and controlgear assemblies to relevant parts of BS EN 61439 are compatible with the ratings of circuits to which they are connected, and with the installation conditions.
Ensure that the relevant fault current (short-circuit) rating of each switchgear and controlgear assembly is greater than or equal to the maximum prospective fault current at the point of connection to the system.
Ensure that the relevant design current does not exceed the rated current of the assembly, or rated current of a circuit of the associated assembly, taking into account applicable diversity and loading factors.

Submit the study as a bound report for approval by the CA. Upon approval by the CA, submit copies of the approved report together with soft copies of the project fault level calculations and discrimination study files in the approved software native format.

310.000 WORKMANSHIP

310.011 INSTALLATION:
Install equipment in accordance with manufacturer's recommendations.

310.012 TESTING and COMMISSIONING
Refer to Y81

10000 NES Version V20 Dec 18

V21 – General Lighting

Incorporating V41 (Street / Area / Floodlighting)

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES

To provide sub-circuit installations from the sub- distribution boards to provide general illumination and, where appropriate, emergency escape lighting.

100.021 DESIGN PARAMETERS

Standards

BS EN 12464-1 - Indoor workplaces.
BS EN 12464-2 – Outdoor work places
BS EN 12193 - Indoor and outdoor sports lighting
BS EN 17037 for daylight in buildings
BS 5489-1 - Roads and public amenity areas

Illuminance levels

Where not stated in the Schedule of Common Design Criteria (Schedule A13) or scope of works, ensure that the maintained illuminance levels meet but do not significantly exceed the CIBSE Code for Lighting (latest edition).

Dependant on Contractor design work required by the scope of works, comply with guidance in latest editions of appropriate SLL guides.

Ensure the initial circuit luminous efficacy for fixed lighting installations is in excess of:

- Ensure minimum colour rendering (R_a) is as CIBSE Code for Lighting.
- Ensure limiting glare rating is as CIBSE Code for Lighting.
- Ensure luminance limits as Table 2.4 of CIBSE Code for Lighting are not exceeded on DSE.
- Ensure the illuminance levels in offices achieve but do not significantly exceed 350-400 lux.
- Ensure the initial circuit luminous efficacy for fixed internal lighting installations is in excess of the following;
  - In office, industrial and storage areas 60 luminaire-lumens/circuit-Watt.
  - Install in dwellings light fittings which can only accept lamps of luminous efficacy more than 45 lumens per circuit-Watt and in excess of 400 lamp lumens.
- Install in dwellings, fixed external lighting fitting;
  - Of lamp capacity not more than 100 Watt with automatic switching off when there is enough daylight and when not required at night or
  - With sockets that can only be used with lamps of efficacy greater than 45 lumens per circuit-Watt.
- Ensure that the installed lighting has an average initial (100 hour) lamp plus ballast efficacy of not less than 50 lamp lumens per circuit-Watt.
- Ensure display lighting has an initial (100 hour) efficacy of not less than, including any transformers or ballast 22 lamp lumens per circuit Watt.

Ensure lighting scheme complies with the Building Regulations Approved Documents (AD) L1A, L1B, L2A, L2B and M and associated Building Services Compliance Guides as appropriate or equivalent in Scotland, Wales and Northern Ireland.

Calculate initial circuit efficacy as AD L2A or L2B, as appropriate.

Use the recommendations in BRE DG 498 for lighting controls.

Contractor to commission the lighting installation in accordance with CIBSE Commissioning Code L : *Lighting* and allow for measuring illumination levels of installation prior to Handing Over, Measurements shall be carried-out in accordance with the SLL Code for Lighting, sections on Instruments and Field Surveys. Commissioning and measurements of lighting installations shall be performed by persons who have demonstrated their competence by passing the 'lighting industry commissioning scheme' operated by the Society of Light and Lighting, Electrical Contractors' Association or National Inspection Council for Electrical Installations.

Unless otherwise stated final lighting circuits shall be radial. Protective device rating and conductor size shall be based on the following:

	Protective device and rating (A)					
MCB	10			16		
Cable size (mm^2)	1.5	2.5	4.0	1.5	2.5	4.0
Maximum circuit length (metres)	20	30	50	10	20	30

Circuit maximum cable lengths reduced. Cable lengths based upon maximum voltdrop of 2% with Ib=0.75In.

Emergency lighting to BS EN 50172, BS 5266, BS EN 1838 and ICEL 1003
Maintain specified illumination level for a period of 3 hours without the use of mains electricity.

100.041 CONTROL REQUIREMENTS:
Refer to scope of works / schedule V21sch1 for control lighting systems / requirements for digital addressable lighting interface; comply with relevant parts of BS EN 62386 and BS EN IEC 62386.

Occupancy detection – refer to scope of works

Dimming
Refer to scope of works and or schedules for details
Ensure dimming system reduces rather than diverts the energy supply.
Provide dimming photoelectric lighting controls to all areas where daylighting levels are sufficient to provide a significant proportion of the required design illuminance levels. Ensure that the sum of daylight and electric lighting always reaches the design level by sensing the total illuminance in the controlled area and adjusting the level of artificial light to meet the design requirements.
Lighting control interface for dimming (Analogue voltage dimming interface for electronic current sourcing control gear) to BS EN IEC 63128

Ensure display lighting has separate dedicated circuits with controls separate from general lighting.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO V21

300.000 GENERAL

300.011 SYSTEM REQUIREMENTS:
Select lighting equipment suitable to meet system objectives and as indicated on the drawings and schedules.
Provide all emergency lighting circuits with local test key switch.
Emergency lamps to energise on failure of local lighting circuit unless otherwise stated.
Illuminate exit, emergency exit and escape route signs so that they are legible at all times, by lamps external to sign or lamps contained within sign as indicated on the drawings.

300.030 ELECTROMAGNETIC COMPATIBILITY
Ensure all equipment and systems are installed to provide electromagnetic compatibility within the systems and with any other systems installed in the same location.

300.050 INTEGRATED SYSTEM:
Where indicated provide integrated system as detailed in the scope of works.

310.000 PRODUCTS/MATERIALS

310.001 WIRING AND CONTAINMENT SYSTEM
Wiring within buildings to be carried out in single core insulated cable enclosed in conduit and or trunking as scheduled.
Trunking routes shown on drawings are primary routes only and all subsidiary trunking and conduits to be provided to form a complete containment system.

310.002 DISPLAY LIGHTING / FLEXIBLE LIGHTING SOURCES:
Refer to scope for project specific requirements

Standards

Relevant parts of BS IEC 62595 and BS EN 62595 for display lighting units and LCD backlight units.
PD IEC TR 62595-1-3 for lighting units with arbitrary shapes such as flexible lighting sources.

310.003 LUMINAIRES AND FIXTURES

Provide luminaires as scheduled and detailed in Y73 complete with means of fixing or supporting. Where installed in suspended ceiling ensure method of fixing is compatible with ceiling type.
Where luminaires incorporate thermoplastic diffusers comply with Building Regulations.

310.011 LIGHTING CONTROL EQUIPMENT

See also clause 100.041 and scope of works.
Where lighting control equipment is specified engage lighting controls specialist to develop the design, supply, install, commission and set to work the lighting control system.
Infrared systems to comply with BS 7693, IEC 61147.

320.000 WORKMANSHIP

320.010 WORK ON SITE:

Ensure all building works are complete and service connections provided.

320.021 INSTALLATION:

Install, commission and to set to work lighting equipment in accordance with manufacturer's recommendations, BS 7671, BS 5266-1 and CIBSE Commissioning Code L : L*ighting*.
Install infra-red transmission systems and co-ordinate the installation of infra-red systems in the same area in accordance with BS 7693.
Ensure luminaires are not installed where temperatures are likely to exceed manufacturers recommended maximum.
Ensure fluorescent luminaires are not used at temperatures below that specified by manufacturer.
Where batteries or indicators are located remote from the emergency luminaire the interconnecting wiring shall be fire-rated. Comply with BS 8519 and BS 5266-1.

320.031 QUALITY CONTROL:

Handle, store and install equipment and components of the lighting system in accordance with manufacturers recommendations. Obtain all equipment and components from a single source.
Inspect all equipment and components on delivery, before fixing and after installation, and reject and replace any that are defective. Record all commissioning, measurements and tests.

10000 NES VERSION TEXT V21 Dec 19 & V41 Dec19

V22 – General Power

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide sub-circuit power installations from the sub-distribution boards terminating with socket outlets, fuse connection units and other outlet accessories.

100.020 DESIGN PARAMETERS
Unless otherwise indicated all final circuits for general LV power circuits shall comprise:

	Protective device and rating (A)						
	MCB	20A		32A		20A	
Circuit type		Ring				Radial	
Cable size (mm^2)	2.5	4.0	2.5	4.0	2.5	4.0	6.0
Maximum circuit length (metres)	35	60	20	35	25	40	60

(Cable sizes are based upon a maximum volt drop of 2% with the circuit loaded to 50% of the cpd rating. For ring circuits a 0.67 current diversity has been used.)
Circuit lengths are taken to the furthest point of utilisation of the circuit for radial circuits or for the route length of the circuit for ring circuits.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO V22

300.000 GENERAL

300.010 SYSTEM REQUIREMENTS
Select equipment suitable to meet system objectives and as indicated on the drawings and schedules.

300.030 ELECTROMAGNETIC COMPATIBILITY
Ensure all equipment and systems are installed to provide electromagnetic compatibility within the systems and with any other systems installed in the same location.

310.000 PRODUCTS/MATERIALS

310.005 WIRING AND CONTAINMENT SYSTEM
Wiring to be carried out in single core insulated cable enclosed in conduit and or trunking as scheduled.
Trunking routes shown on drawings are primary routes only and all subsidiary trunking and conduits to be provided to form a complete containment system.

310.006 POWER USING EQUIPMENT AND FIXTURES
Provide equipment as scheduled complete with means of fixing or supporting.

310.007 POWER TO MECHANICAL PLANT
Refer to W60 for details.
Provide fused connection unit adjacent to each item of local plant that is not fed from an MCC, final connection to be by the Controls Specialist.
Provide power to all MCC's, distribution boards etc supplied by the Controls Specialist.

320.000 WORKMANSHIP

320.010 WORK ON SITE:
Ensure all building works are complete and service connections provided.

320.021 INSTALLATION:
Install, commission and to set to work equipment in accordance with manufacturer's recommendations and BS 7671 IET Wiring Regulations.

320.031 QUALITY CONTROL:
Handle, store and install equipment and components in accordance with manufacturers' recommendations. Obtain all equipment and components from a single source.

V22 – General Power

Inspect all equipment and components on delivery, before fixing and after installation, and reject and replace any that are defective. Record all commissioning, measurements and tests.

10000 NES VERSION V22 Text Dec 19

V32 – Uninterruptible Power Supply

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide a 'conditioned' uninterrupted power supply to essential equipment and in the event of failure of the normal electrical supply, for the specified duration.

100.020 DESIGN PARAMETERS
To provide a standalone UPS machine(s) complete with batteries and cubicle.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO V32.

300.000 GENERAL

300.010 SYSTEM REQUIREMENTS:
Design, supply, install and set to work an uninterruptible power supply (UPS) in accordance with:
- The Electricity at Work Regulations 1989
- The Waste Batteries and Accumulators Regulations 2009
- BS 7671 IET Wiring Regulations, including the particular requirements of BS 7671 Section 551 Generating sets
- BS EN 62040 series

Noise limit – Unless scheduled otherwise, limit equipment noise level to 72 dBA as per BS EN ISO 3746, measure 1m from each surface of equipment enclosures.

300.030 UPS SPECIALIST:
Engage a specialist to develop the design, supply, install, commission and set to work the UPS.

300.040 ELECTROMAGNETIC COMPATIBILITY:
Ensure all equipment and installation complies with the Electromagnetic Compatibility Regulations 2016.
Ensure all equipment carries the CE Mark, and is suitable for the electromagnetic environment in which it is to be used, for the service to which it is to be put.

300.050 INTEGRATION, CONTROL AND MONITORING:
Provide an integrated system as detailed in the scope of works / schedules.
Equipment to be controlled / monitored should interface with BMS Building management system
Energy management and data network management system as detailed elsewhere in this specification via:
- Local outstations / control panels

Supervisory control and data acquisition system via:
- Local outstations / control panels

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300.060 SOFTWARE:
Obtain on behalf of the end users all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Provide documentation for application software in accordance with BS ISO/IEC 26513 and BS ISO/IEC 26514.
Ensure that, as far as practicable, all software is commercially available off-the-shelf.
Ensure that any programmable configuration, customisation, and bespoke software, is developed, tested and commissioned using relevant processes and procedures complying with BS ISO/IEC/IEEE 12207 or BS ISO/IEC/IEEE 15288, supported by a quality management system meeting the requirements of BS EN ISO 9001.

310.000 PRODUCTS/MATERIALS

310.011 PACKAGED UPS SYSTEMS
Refer to schedules for type, details and duty
Refer to Y92 and schedules for electric motors.
Refer to V10 and schedules for generators.

Comply with standards appropriate to the particular project:
- BS EN IEC 62040-1 - for general and safety requirements
- BS EN IEC 62040-2 - for EMC requirements

BS EN 62040-3 - performance and test requirements
BS EN 62040-4 - requirements and reporting for environmental aspects
BS EN 62040-5-3 - for DC output UPS
Protection in accordance with BS 7671 (IET Wiring Regulations)
Stationary battery installations to BS EN IEC 62485-1 and BS EN IEC 62485-2
Energy Networks Association Engineering Recommendation G5/4-1 for planning levels for harmonic voltage distortion

Rating and configuration as indicated on the Drawings and Schedules.

Provide equipment suitable for unattended operation indoors

Provide rigid steel free standing floor-mounted enclosure.

Access Full size lockable doors to give access to all compartments. Provide two sets of keys.

Finish Remove rust and scale. Apply anti-corrosive primer and stoved epoxy powder coating two-coat paint system

Colour Manufacturer's standard – external -RAL 9010 30% Gloss (white) – internal

Ventilation Provide cooling fans to permit unit to operate at full rated load with one fan out of service

Earth terminal Brass, minimum size, ISO M10

Components

Transformer–rectifier
Bypass system
Switchgear
Electrical protection
Instruments
Control and indication
Power converting equipment (PCE)
Batteries and chargers

310.021 TRANSFORMER-RECTIFIER

Standard Relevant parts of BS EN 60146

Provide continuously rated unit to supply full rated input load of the inverter plus maximum battery charging current. Include double wound input transformer.

To meet G5/4-1, incorporate suitable harmonic filtering systems to limit current distortion (THDI) to 5% at input to UPS system, as drawn from mains supply.

Duty

6-pulse transformer/rectifier for outputs up to and including 100kVA
12-pulse transformer/rectifier for outputs over 100kVA
Temperature compensated charging of batteries for UPS rating of 30kVA and over

Incorporate phase-shifting of input supplies to multi-unit systems to reduce total harmonic current drawn from mains supply

310.025 MOTOR/GENERATOR SET / DIESEL ENGINE

Refer to scope of works / schedules and Y92 for motor details.
Refer to V10 for details of diesel engine / generator

310.030 BYPASS SYSTEM

Automatic bypass

Provide automatic static switch bypass to transfer load to bypass supply, without a supply break, when output of inverter deviates from specified limits. Inhibit operation of bypass if inverter output is not in synchronism with bypass supply.

Manual bypass

Incorporate internal manual bypass with arrangements for completely isolating the equipment from all supplies for maintenance or provide for connection of external manual bypass supplied and installed by others (refer to drawings for applicability)

UPS Conditioning Bypass

Provide automatic static switch bypass to bypass inverter when supply deviates from specified limits. Inhibit operation of bypass if supply is not in synchronisation with inverter output.

Comply with BS 7671 (IET Wiring Regulations) requirements to ensure that:

The UPS system has a means of earthing in the event that the supply earth is disconnected or broken in accordance with Section 531 and 551.

In charging over the supply, the incoming supply neutral is not connected to earth at more than one point in the entire supply system in accordance with Section 543.

310.040 SWITCHGEAR

Provide isolation during repair and maintenance work in accordance with BS EN 62626-1
Standards

Switchgear and controlgear assemblies to BS EN 61439 series
Miniature circuit-breakers to BS EN 60898 series
Residual current operated circuit-breakers to BS EN 61008 series and BS IEC 1008-2-2.
Moulded case circuit-breakers to BS EN 60947-2.
Low-voltage switches, disconnectors, switch disconnectors and fuse combination units to BS EN 60947-3.
Contactors to BS EN 60947-4-1.

310.050 ELECTRICAL PROTECTION

Provide isolation during repair and maintenance work in accordance with BS EN 62626-1
Incorporate protection against damage due to: -

Overload and short-circuit on the output
Failure of internal components
Overheating due to failure of internal fans

Output protection

Provide DC protection by
Fuse combination unit to BS 88 (BS EN 60269)
DC rated circuit-breaker to BS EN 60898-2

Input protection

Provide AC input circuit-breaker to
BS EN 60898-1.
BS EN 60947-2.
Provide fuse combination unit to BS EN 60269-1, BS 88-1 and BS EN 60269-4, BS 88-4.

Solid-state power component protection

Fast-acting current-limiting devices.
Fuses complying with BS EN 60269-4, BS 88-4.

310.060 INSTRUMENTS

Provide flush mounted instruments in dust and moisture resistant cases.
Refer to Y71-2151 for standards.
Instruments required

Input supply voltmeter

For 3-phase provide phase-phase and phase-neutral selector switch
Input supply ammeter with phase-phase and phase-neutral selector
Output supply voltmeter with phase-phase and phase-neutral selector switch
Output ammeter with phase-phase and phase-neutral selector switch
Load crest factor and power factor display meter
Simultaneous display of all phases required for above meters

310.070 CONTROL AND INDICATION

Provide system mimic diagram and indications / alarms as detailed in Schedule V32sch.

Colour

Colour indicator lights and push-buttons in accordance with BS EN 60073

310.080 POWER CONVERTING EQUIPMENT

Provide static inverter to supply rated load continuously and 150% rated load for 10 seconds in any period of 15 minutes to BS EN 60146 series.

Control output frequency automatically to enable unit to operate in synchronism with bypass supply but to run independently when bypass supply deviates from specified limits of voltage or frequency. Provide manual adjustment of frequency within the range +5% of nominal.

Provide on-load switch disconnector at output of converter system. Include double-wound output transformer and filters to reduce the harmonic content of the output voltage waveform to specified limits when supplying rated output to load of indicated characteristics. Comply with BS IEC 60747 series and BS IEC 60748 series for the application of power switching semiconductors.

Line-drop compensation

Provide line-drop compensation to increase output voltage linearly with load current to compensate for cabling voltage drop. Include manual adjustment of voltage compensation at full load over the range of 0-5% of nominal voltage.

Provide isolation between input and output, to facilitate TN-S supply on loss of input supply.

310.091 BATTERIES AND CHARGERS

Standards for safety of batteries and battery installations:

BS 7671 (IET Wiring Regulations)
BS EN IEC 62485-1 general requirements for secondary batteries and battery installations
BS EN IEC 62485-2 requirements for stationary batteries and battery installations

Battery type

Unless scheduled otherwise - lead/acid valve regulated BS EN 60896-21 and BS EN 60896-22
Sealed

Connections

Provide intercell and output connections shielded with impact resistant plastic to prevent inadvertent contact

Direct acting analogue electrical measuring instruments (for UPS's rated above 6kVA) - comply with BS EN 60051-1

Battery voltmeter

Battery ammeter to indicate charge/discharge current

Battery housing

Supply ventilated steel battery cubicle with acid-resistant finish

Protection/isolation

Provide battery on-load switch disconnector with air circuit breaker

Charger

Provide current-limited constant-voltage charging system from transformer-rectifier

Comply with battery manufacturer's recommendations for current limit and fault voltage. Include overcurrent and overvoltage protection.

Provide earth fault detection and alarm where battery and charging system are not connected to earthed system.

Limit step load on mains after supply restoration to 50% of full load followed by gradual transfer of load from battery to mains over a period of one minute.

320.000 WORKMANSHIP

320.010 INSTALLATION

Install equipment in accordance with BS 7671 (IET Wiring Regulations) and manufacturer's recommendations.
Store and transport all equipment and materials in accordance with manufacturer's instructions:
- Comply with manufacturers' safety guidelines in safe storage and transportation of batteries
- Comply with BS EN 62281 for the safety of lithium cells and batteries during transportation and storage

Provide labelling in accordance with BS 7671 and BS EN ISO 7010:
- Safe isolation of multiple sources of supply to affect safe maintenance
- Emergency stop
- Relevant battery hazard warning labels

320.020 COMMISSIONING:

Undertake initial verification in accordance with BS 7671 (IET Wiring Regulations) and the IET Code of Practice for Electrical Energy Storage Systems
- Verify the resistance of the supplementary equipotential bonding system is below the value specified.

Ensure the correct operation of the system, including all indications, alarms and controls.

320.030 QUALITY CONTROL:

Record all commissioning measurements and tests and site modifications to hardware or software, and revise operating and maintenance instructions accordingly.
Manage configuration of software settings, data and design, in accordance with an appropriate Configuration Management Plan (CMP), complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC/IEEE 12207 and BS ISO/IEC/IEEE 15288.
Provide configuration details along with the operation and maintenance manual on handover.
Manage information security of systems, software and data during design, implementation and commissioning in line with BS EN ISO/IEC 27001.

320.040 HANDOVER:

Provide the following diagrams and documentation in the operation and maintenance manual in accordance with BS 7671 (IET Wiring Regulations):
- Overview diagrams showing the system in single-line representation
- Distribution board block diagrams showing switchgear and controlgear and distribution boards in single-line representation.
- Schematic diagrams of control
- Evidence of verification of compliance with requirements of the relevant standards

Provide training to operation and maintenance staff of the operation of the system, including safe isolation and shutdown procedures.

V34 - Electric Vehicle Charging Equipment Installations

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
Refer to scope of works or schedules for details.

100.020 DESIGN PARAMETERS
Design the electric vehicle charging installation in accordance with the following as appropriate to the project particular requirements in the scope of work / schedules:

- BS 7671 IET Wiring Regulations
- IET Code of Practice for Electric Vehicle Charging Equipment Installation
- BS 8300-1 and BS 8300-2 for accessibility
- For installations in the curtilage of fuel filling stations, Energy Institute / Association of Petroleum and Explosives Administration publication, Guidance for Design, Construction, Modification, Maintenance and Decommissioning of Filling Stations (Blue Book)
- ENA Engineering Recommendations for grid-connected vehicle-as-storage systems:
  - G98 Recommendations for the Connection of Type Tested Small-scale Embedded Generators (up to 16 A per phase) in parallel with public Low Voltage Distribution Networks on or after 27 April 2019, for sites where the total grid-connected generation is up to 16 A per phase and connects at voltages
  - G99 Requirements for the connection of generation equipment in parallel with public distribution networks on or after 27 April 2019, for sites where the total grid-connected generation exceeds 16 A per phase, or at connection voltages exceeding 230 V single-phase
  - G100 Technical Requirements for Customer Export Limiting Schemes
  - G5/4-1 for harmonic content

Earthing arrangements and means of protection against electric shock
Undertake a design risk assessment in accordance with the IET Code of Practice for Electric Vehicle Charging Installations, to determine the earthing arrangements and means of protection against electric shock for each charging point:
Dwelling installation assessment (Appendix B to the IET Code of Practice for Electric Vehicle Charging Equipment Installation)
On-street installation assessment (Appendix C to the IET Code of Practice for Electric Vehicle Charging Equipment Installation)
Commercial and industrial installation assessment (Appendix D to the IET Code of Practice for Electric Vehicle Charging Equipment Installation)
For fuel filling station installation assessment (Appendix E to the IET Code of Practice for Electric Vehicle Charging Equipment Installation)

PART 3 SPECIFICATION CLAUSES SPECIFIC TO V34.

300.000 GENERAL

300.010 SYSTEM REQUIREMENTS:
Supply, install and set to work an electric vehicle charging equipment installation in accordance with:

- BS 7671 (IET Wiring Regulations)
- BS 7430 code of practice for protective earthing of electrical installations
- Relevant parts of BS EN 61851 and BS EN IEC 61851 for electric vehicle supply equipment
- IET Code of Practice for Electric Vehicle Charging Equipment Installation
- BS 8300-1 and BS 8300-2 for accessibility
- BS EN 61439 series for switchgear and controlgear assemblies

Ensure that there are no simultaneously-accessible extraneous-conductive-parts and/or exposed-conductive-parts (including metal bodies of vehicles on charge, unless electrical separation is used) of:
Other electrical installations
Parts of the system with different earthing arrangements
Accessibility standards

- BS 8300-1 for the external environment
- BS 8300-2 for buildings

300.020 ADDITIONAL SYSTEM REQUIREMENTS FOR FUEL FILLING STATIONS:

Comply with Energy Institute / Association of Petroleum and Explosives Administration publication, Guidance for Design, Construction, Modification, Maintenance and Decommissioning of Filling Stations (Blue Book).

Ensure all electric vehicle charging equipment, and the vehicles on charge, are outside any hazardous area.
Ensure electric vehicle charging equipment enables connection only via an integral tethered cable.
Ensure that the supply to the electric vehicle charging equipment is controlled by the forecourt emergency switching system, and controls for lighting and signage so that power is removed from electric vehicle charging and supply equipment when the filling station is closed.

Where a separate supply is provided for the charging equipment:

- Ensure the Utility Company supply cable is routed across or round the filling station forecourt so that it does not pass under any hazardous area.
- Provide a TT earthing system for the charging equipment and ensure that this is connected to the filling station TT earthing system.
- Ensure that the electric vehicle charging installation is not connected to an earthing system separate from that of the filling station.
- Affix a prominent warning label on the supply cubicle t indicate that the charger is fed from this separate supply and is not controlled by the fuel filling station main switch.
- Provide fibre optic control cables to facilitate control from the forecourt emergency switching system and controls for the lighting and signage.

300.030 ADDITIONAL REQUIREMENTS FOR VEHICLE-AS-STORAGE SYSTEMS:

Additional standards for vehicle-as-storage systems:

- BS EN 50539-1 for micro-generating plants to be connected in parallel with public low-voltage distribution networks
- IET Code of Practice for the Electrical Energy Storage Systems
- BS HD 60364-8-2 (prosumer's electrical installations)
- ENA engineering recommendations for grid-connected systems as appropriate to the project particular requirements in the scope of work / schedules:
  - G98 Recommendations for the Connection of Type Tested Small-scale Embedded Generators (up to 16 A per phase) in parallel with public Low Voltage Distribution Networks on or after 27 April 2019, for sites where the total grid-connected generation is up to 16 A per phase and connects at voltages not exceeding 230 V single-phase or 400 V three-phase.
  - G99 Requirements for the connection of generation equipment in parallel with public distribution networks on or after 27 April 2019, for sites where the total grid-connected generation exceeds 16 A per phase, or at connection voltages exceeding 230 V single-phase or 400 V three-phase.
  - G100 Technical Requirements for Customer Export Limiting Schemes
  - G5/4-1 for harmonic content

Lightning and surge protection

- Provide lightning protection in accordance with BS EN 62305 series
- Provide surge protection in accordance with BS EN 62305 series, BS 7671 (IET Wiring Regulations) and BS EN 50174-3

Provide additional protection by residual current device (RCD) for island-mode operation in accordance with IET Code of Practice for Electrical Storage Systems.
Provide an additional means of earthing for island-mode operation, in accordance with the IET Code of Practice for Electrical Energy Storage Systems.

300.040 SITE RISK ASSESSMENT:

Where requested in the scope of works or schedules conduct a site assessment and risk assessment in accordance with the IET Code of Practice for Electric Vehicle Charging Equipment Installations:

- Dwelling installation assessment (Appendix B to the IET Code of Practice for Electric Vehicle Charging Equipment Installation)
- On-street installation assessment (Appendix C to the IET Code of Practice for Electric Vehicle Charging Equipment Installation)
- Commercial and industrial installation assessment (Appendix D to the IET Code of Practice for Electric Vehicle Charging Equipment Installation)
- For fuel filling station installation assessment (Appendix E to the IET Code of Practice for Electric Vehicle Charging Equipment Installation)

300.060 ELECTRICAL VEHICLE CHARGING INSTALLATION SPECIALIST:

Engage a specialist to develop the design, supply, install, commission and set to work the electric vehicle charging installation.

For fuel filling station installations, ensure that all operatives are trained and qualified in accordance with the Petrol Retail Forecourt Contractors safety passport scheme.

300.070 ELECTROMAGNETIC COMPATIBILITY:

Ensure all equipment complies with the Electromagnetic Compatibility Regulations 2016.

Ensure all equipment carries the CE Mark, and is suitable for the electromagnetic environment in which it is to be used, for the service to which it is to be put.

300.080 INTEGRATION, CONTROL AND MONITORING:

Provide integrated system. Combine the electric vehicle charging installation with the sub-systems as described in the project particular requirements in the scope of work / schedules:

Monitoring and control protocols:

- Profibus BS EN 62769
- Profinet BS EN 62769
- Modbus
- Modbus over Ethernet
- OPC BS EN 62541
- BACnet
- "Wired" interfaces to BS EN 61131-2
  - Volt-free contacts
  - Relay driven

Metering data

- Relevant parts of BS EN 62056, BS EN IEC 62056 and PD IEC/TS 62056
- PD CLC/TS 50568-4 and PD CLC/TS 50568-8
- BS EN 61968-9
- BS EN 50491-11

300.090 SOFTWARE:

Obtain on behalf of the end users all appropriate licences, permissions, copyright waivers, rights of use etc. from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Provide documentation for application software in accordance with BS ISO/IEC 26513 and BS ISO/IEC 26514.

Ensure that, as far as practicable, all software is commercially available off-the-shelf.

Ensure that any programmable configuration, customisation, and bespoke software, is developed, tested and commissioned using relevant processes and procedures complying with BS ISO/IEC/IEEE 12207 or BS ISO/IEC/IEEE 15288, supported by a quality management system meeting the requirements of BS EN ISO9001.

310.000 PRODUCTS AND MATERIALS

310.010 ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE):

Standards

- BS 7671 (IET Wiring Regulations)
- Relevant parts of BS EN 61851 and BS EN IEC 61851 for electric vehicle supply equipment
- BS EN 61558-2-4 where isolation transformers are integral
- BS 8300-1 and BS 8300-2 for accessibility
- BS EN 61439 series for switchgear and controlgear assemblies

Charging mode(s):

Mode 2 at the following voltages:

230 V 50 Hz single-phase AC

Mode 3, at the following voltages:

230 V 50 Hz single-phase AC

400 V 50 Hz three-phase AC

Mode 4 (DC charging)

Infrastructure-side connectors - Refer to the project particular requirements in the scope of work / schedules:
- Mode 2 charging:
  - Socket-outlet to BS 1363-2 clearly labelled "Electric Vehicle Connecting Point".
  - Socket-outlet to BS EN 60309-2 or BS EN 60309-4.
- Mode 3 charging:
  - BS EN 62196-2 Type 2.
  - BS EN 62196-3 Type 3.

Vehicle connectors - Refer to the project particular requirements in the scope of work / schedules:
- Mode 2 charging:
  - BS EN 62196-2 Type 1.
  - Socket-outlet to BS 1363-2, clearly labelled "Electric Vehicle Connecting Point".
  - Socket-outlet to BS EN 60309-2 or BS EN 60309-4.
- Mode 3 charging:
  - BS EN 62196-2 Type 1.
  - BS EN 62196-3 Type 2.
- Mode 4 charging:
- CHAdeMO or Combined charging system (CCS)

310.020 ISOLATION TRANSFORMER:

Standard
- BS 7671 (IET Wiring Regulations)
- BS EN 61558-2-4

310.030 POWER CONVERTING EQUIPMENT (PCE):

Standards
- BS 7671 (IET Wiring Regulations)
- Harmonic performance to Electricity Networks Association Engineering Recommendation G5/4-1

Provide solid state type automatic voltage regulating converter with output within indicated percentage of rated voltage.

310.040 BACKUP ISOLATOR FOR VEHICLE-AS-STORAGE SYSTEMS:

Standards
- BS EN 61439 series for switchgear/controlgear assemblies
- BS EN 50438 for micro-generating plants to be connected in parallel with public low-voltage distribution networks
- BS 7671 (IET Wiring Regulations), BS HD 60364-8-2 (prosumer's electrical installations) and IET Code of Practice for Electrical Energy Storage Systems, for design, installation and verification
- Electricity Networks Association Recommendations G98 or G99 as relevant

Provide a backup isolator to isolate the installation from grid supply in island-mode.

Ensure the backup isolator line and neutral contacts are capable of making and breaking the full maximum demand of the installation.

320.000 WORKMANSHIP

320.010 INSTALLATION:

Install, inspect and test the electric vehicle charging equipment and associated equipment in accordance with:
- BS 7671 (IET Wiring Regulations)
- Manufacturer's instructions
- IET Code of Practice for Electric Vehicle Charging Equipment Installation
- Energy Institute / Association of petroleum and Explosives Administration publication, Guidance for Design, Construction, Modification, Maintenance and Decommissioning of Filling Stations (Blue Book), for fuel filling station installations
- IET Code of Practice for Electrical Energy Storage Systems, where the system includes vehicle-as-storage
- Energy Institute / Association of Petroleum and Explosive Atmospheres

Store and transport all equipment and materials in accordance with manufacturer's instructions.

For installations that include vehicle-as-storage, provide labelling in accordance with BS 7671, ENA Engineering Recommendations G98 or G99, BS EN ISO 7010 and the IET Code of Practice for Electrical Energy Storage Systems:
- Safe isolation of multiple sources of supply to effect safe maintenance.
- Multiple sources of supply label in accordance with ENA Engineering Recommendations G98 or G99.

Emergency stop.

For installations in fuel filling stations, provide labelling required by Energy Institute / Association of Petroleum and Explosives Administration publication, Guidance for Design, Construction, Modification, Maintenance and Decommissioning of Filling Stations (Blue Book).

320.020 COMMISSIONING:

Undertake initial verification in accordance with BS 7671 (IET Wiring Regulations) and the IET Code of Practice for Electric Vehicle Charging Equipment Installation.

For fuel filling stations, comply with the Energy Institute / Association of Petroleum and Explosives Administration publication, Guidance for Design, Construction, Modification, Maintenance and Decommissioning of Filling Stations (Blue Book).

Where the installation incorporates vehicle-as-storage:

Undertake additional initial verification and commissioning in accordance with the IET Code of Practice for Electrical Energy Storage Systems.

Ensure the correct operation of the system, including all indications, alarms and controls.

Undertake initial system tuning.

Undertake post-handover tuning to ensure continued effectiveness at 6 months from handover and 12 months from handover.

320.030 QUALITY CONTROL:

Record all commissioning measurements and tests and site modifications to hardware or software, and revise operating and maintenance instructions accordingly.

Manage configuration of software settings, data and design, in accordance with an appropriate Configuration Management Plan (CMP), complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC/IEEE 12207 and BS ISO/IEC/IEEE 15288.

Provide configuration details along with the operation and maintenance manual on handover.

Manage information security of systems, software and data during design, implementation and commissioning in line with BS EN ISO/IEC 27001.

320.040 HANDOVER:

Provide the following diagrams and documentation in the operation and maintenance manual in accordance with BS 7671 (IET Wiring Regulations):

Overview diagrams showing the system in single-line representation

Distribution board block diagrams showing switchgear and controlgear and distribution boards in single-line representation

Schematic diagrams of controls

Functional description for the operation, manual mode selection, and safety shutdown procedures

Evidence of verification of compliance with requirements of the relevant standards

Provide training in operation of the system to owner / occupier.

V40 – Emergency Lighting

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES

To provide temporary illumination to escape routes, walkways, selected areas and signs by means of separate lighting systems in the event of failure of the normal lighting systems.

100.020 DESIGN PARAMETERS

Minimum lighting level to conform to the requirements of BS EN 1838 and BS EN 50172 (BS 5266-8).
Maintain specified lighting level for a period of 3 hours without the use of mains electricity
Unless otherwise indicated all final lighting circuits shall comprise

	Protective device and rating (A)					
MCB		10			16	
Cable size (mm^2)	1.5	2.5	4.0	1.5	2.5	4.0
Maximum circuit length (metres)	20	30	50	10	20	30

Circuit lengths are taken to the furthest point of utilisation of the circuit, plus the length of switch lines.

100.040 CONTROL REQUIREMENTS

Provide all emergency lighting circuits with local test key switch.
Emergency lamps to energise on failure of local lighting circuit unless otherwise stated.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO V40

310.000 GENERAL

300.011 EMERGENCY LIGHTING SYSTEM:

Standards

- BS EN 50172 (BS 5266-8) for emergency escape lighting systems.
- BS 5266-2 for low mounted way guidance systems for emergency use.
- BS 5266-4 for design, installation, maintenance and use of optical fibre systems.
- BS 5266-5 for component parts of optical fibre systems.
- BS 5266-6 for photoluminescent systems for emergency way guidance.
- BS EN 13032-3 for photometric data
- BS EN 1838 for emergency lighting applications.
- BS EN 50171 for central power supply systems.
- BS EN 62034 for automatic test systems for battery powered emergency escape lighting.
- BS 5266-1 for general recommendations and guidance for the emergency lighting in premises other than dwellings.
- SLL CIBSE LG12/15 for emergency lighting in general.
- SLL CIBSE LG2 for hospitals and health care buildings.
- BS EN 12193 for additional considerations for emergency lighting in sports venues
- Any Local Authority specific requirements.

300.020 ILLUMINATION OF SIGNS:

Illuminate exit, emergency exit and escape route signs so that they are legible at all times, by lamps external to sign or lamps contained within sign as indicated on the drawings.

300.030 INTEGRATION, CONTROL AND MONITORING:

Provide an integrated system where detailed in the scope of works / schedules.
Equipment to be controlled / monitored should interface with BMS, the fire detection and alarm system or the building's Supervisory control and data acquisition system via:

- Local outstations / control panels

Supervisory control and data acquisition system via:

- Local outstations / control panels

Fire detection and alarm system:

- Ensure interfaces to fire detection and alarm system comply with the relevant parts of BS 5839 and BS 7273.
- Ensure relevant equipment complies with BS EN 50130-4.

300.040 SOFTWARE:
Where appropriate, obtain on behalf of the end users all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Provide documentation for application software in accordance with BS ISO/IEC 26513 and BS ISO/IEC 26514.
Ensure that, as far as practicable, all software is commercially available off-the-shelf.
Ensure that any programmable configuration, customisation, and bespoke software, is developed, tested and commissioned using relevant processes and procedures complying with BS ISO/IEC/IEEE 12207 or BS ISO/IEC/IEEE 15288, supported by a quality management system meeting the requirements of BS EN ISO 9001.

310.000 PRODUCTS/MATERIALS

310.011 LAMPS FOR EMERGENCY LIGHTING:
As indicated on the drawings and schedules.

310.021 SELF-CONTAINED EMERGENCY LUMINAIRE SYSTEM AND EQUIPMENT
Provide green LCD luminaire healthy and red LCD luminaire fault (where specified) indicator in accordance with BS EN 60598-2-22 and BS EN 60073 (coding principles for indicators).

310.026 LOW MOUNTED WAY GUIDANCE SYSTEMS FOR EMERGENCY USE
Standards BS 5266 Parts 1, 2, and 5, BS EN 50172, and BS EN 60598-2-22.

310.027 OPTICAL FIBRE EMERGENCY LIGHTING SYSTEM
Standards BS 5266-4 and BS 5266-5

310.030 CENTRAL BATTERY EQUIPMENT:
Standard BS EN 50171 and ICEL 1009 and as indicated on the drawings and schedules.

Refer to schedule V40sch for project specific requirements.

310.040 BATTERY CHARGERS:
Standards - BS EN 60335-2-29, (battery chargers for household and similar applications), relevant parts of BS EN 60146, (semiconductor converters), BS EN IEC 62485-2 (stationary secondary batteries and battery installations - safety requirements), BS EN 50171 (central power supply systems) and ICEL 1009:2000
Type - as scheduled.

310.050 MAINS FREQUENCY CENTRAL INVERTERS:
Standards - relevant parts of BS EN 50171, BS EN IEC 62040-1 and ICEL 1009:2000

310.060 ANCILLARIES:
Provide ancillaries in accordance with the appropriate standards and regulatory authority requirements.

320.000 WORKMANSHIP

320.011 INSTALLATION:
Install, test and commission emergency lighting system and luminaires in accordance with the relevant parts of BS 5266, BS EN 50172 (BS 5266-8), BS EN 1838 and BS 7671 (IET Wiring Regulations).

320.012 REMOTE BATTERY AND INDICATOR CONNECTIONS
Where batteries are located remote from the luminaire the interconnecting wiring shall be fire-rated in accordance with BS 5266-1

320.020 SELF-CONTAINED LUMINAIRES:
Ensure self-contained luminaires are not installed where temperatures are likely to exceed manufacturers recommended maximum.
Ensure fluorescent luminaires are not used at temperatures below that specified by manufacturer.

320.030 EQUIPMENT:
Install equipment in accordance with manufacturer's recommendations.

320.040 QUALITY CONTROL:

Record all commissioning measurements and tests and site modifications to hardware or software, and revise operating and maintenance instructions accordingly.

Manage configuration of software settings, data and design, in accordance with an appropriate Configuration Management Plan (CMP), complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC/IEEE 12207 and BS ISO/IEC/IEEE 15288.

Provide configuration details along with the operation and maintenance manual on hand-over.

Manage information security of systems, software and data during design, implementation and commissioning in line with BS EN ISO/IEC 27001.

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PART 1 SYSTEM OBJECTIVES

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W10.

300.000 GENERAL

300.010 TELECOMMUNICATIONS SYSTEMS:

91. Supply, install, commission and set to work a telecommunications system.
92. Standards
- BS 7671 (IET Wiring Regulations)
- BS EN 50174-1 information technology cabling installation specification and quality assurance
- BS EN 50174-2 information technology cabling installation planning and practices inside buildings
- BS EN 50174-3 information technology cabling installation planning and practices outside buildings
- PD CLC/TR 50174-99-1 information technology cabling remote powering installations
- BS EN IEC 62485-1 general requirements for secondary batteries and battery installations
- BS EN IEC 62485-2 requirements for stationary batteries and battery installations
- BS EN 50310 earthing and bonding in buildings with information technology equipment
- BS 6701 telecommunications equipment and telecommunications cabling
- BS EN 62949 particular requirements for equipment to be connected to information and communication technology networks
- BS EN 60950-1 safety of information technology equipment
- BS EN 62368-1 safety requirements for audio, video and information technology equipment

105. [.....]
106. Publicly available telephone service provider [.....]
107. System apparatus
108. Network.
109. PBX.
110. Telephones.
111. Data [.....]
112. Facsimile.
113. Voice over Internet Protocol (VoIP) gateways.
114. PBX with Internet Protocol (VoIP) handsets.
115. Voice over Internet Protocol (VoIP) client software.
116. [.....]

300.020 APPROVALS:

Ensure that all apparatus and equipment provided for the telecommunications system complies with the provisions of the Radio and Telecommunications Terminal Equipment Regulations 2000 as amended, and where necessary the Communications Act 2003 as amended by the Electronic Communications and Wireless Telegraphy Regulations 2011.

300.040 TELECOMMUNICATIONS SPECIALIST:

Engage a specialist to carry out all aspects of supply, installation, setting to work and handing over to designated maintainer of the telecommunications system.
Specialist [.....]

300.050 ELECTROMAGNETIC COMPATIBILITY:

Ensure all equipment and systems and equipment are designed and installed in accordance with due consideration to good EMC practice, and in line with the EMC requirements of relevant standards including BS 6701, BS 7671, BS EN 50310, BS EN 50174-1, BS EN 50174-2, BS EN 50174-3.
Ensure all equipment complies with the EMC Regulations (2006), carries the CE Mark, and is suitable for the electromagnetic environment in which it is to be used, for the service to which it is to be put.

300.060 REMOTE POWER FEEDING SYSTEM:

Ensure that when remote power feeding systems are used they comply with BS EN 60950-21 or BS ISO/IEC/IEEE 8802-3 and that appropriate safety precautions and devices are installed to protect the user and service persons.

300.070 SOFTWARE:

Obtain on behalf of the end users all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Provide documentation for application software in accordance with BS ISO/IEC 26513 and BS ISO/IEC 26514.

Ensure that, as far as practicable, all software is commercially available off-the-shelf.

Ensure that any programmable configuration, customisation, and bespoke software, is developed, tested and commissioned using relevant processes and procedures complying with BS EN ISO/IEC/IEEE 12207 or BS ISO/IEC/IEEE 15288, supported by a quality management system meeting the requirements of BS EN ISO 9001.

310.000 PRODUCTS/MATERIALS

310.010 PRIVATE TELEPHONE NETWORK:

117. Network
  118. Switched.
  119. Unswitched.
120. Network terminating points.
  121. BT.
  122. IP (VoIP network)
  123. [.....]
124. Switching nodes
  125. PBX.
  126. Tandem exchanges.
  127. PBX with Internet Protocol.
  128. VoIP Gateway.
  129. [.....]
130. Links between nodes
  131. PTO private circuits.
  132. Cabling [.....]
  133. [.....]
134. Terminating stations [.....]
135. [.....]

310.020 STRUCTURED CABLING SYSTEMS:

Standards

- BS EN 50173-1 generic cabling systems – general requirements
- BS EN 50173-2 generic cabling systems for office spaces
- BS EN 50173-3 generic cabling systems for industrial spaces
- BS EN 50173-4 generic cabling systems for homes
- BS EN 50173-5 generic cabling systems for data centres
- BS EN 50173-6 generic cabling systems for distributed building services
- Class of performance [.....]
- BS EN 50174-1 – cabling installation specification and quality assurance
- BS EN 50174-2 - cabling installation – installation planning and practices inside buildings
- BS EN 50174-3 - cabling installation – installation planning and practices outside buildings

310.030 PRIVATE BRANCH EXCHANGES:

Standard

BS EN 60065 safety of audio, video and similar equipment
BS EN 60950-1 safety of information technology equipment
BS EN 62368-1 safety requirements for audio, video and information technology equipment
BS EN 62949 particular requirements for equipment to be connected to information and communication technology networks

136. Exchange type
  137. PABX.
  138. VoIP [.....]
  139. Key system.
  140. Call centre.
  141. [.....]
142. Size
  143. Traffic capacity, (erlang) [.....]

144. PSTN - analogue exchange lines [.....]
145. Analogue telephone ports [.....]
146. Digital telephone ports [.....]
147. Extension voice and data [.....]
148. Extension data only [.....]
149. Analogue private lines [.....]
150. Digital private lines [.....]
151. PSTN ISDN lines [.....]
152. Operator consoles [.....]
153. Supervisors/management consoles [.....]

154. Switching protocol and networking
155. Digital [.....]
156. SPC [.....]
157. Port switch [.....]
158. Bus switch [.....]
159. DPNSS [.....]
160. MF4 signalling [.....]
161. HDLC [.....]
162. DASS1 [.....]
163. DASS2 [.....]
164. ISDN [.....]
165. Q931
166. IP [.....]
167. [.....]

168. System Features and Facilities
169. Alarms [.....]
170. Automatic extension release [.....]
171. Automatic wake-up [.....]
172. Barring - extension to extension [.....]
173. Call diversion [.....]
174. Call information logging [.....]
175. Call queuing [.....]
176. Data entry and user security code [.....]
177. Debate calls [.....]
178. Dial tone options [.....]
179. Dial pulse and MF4 operation [.....]
180. Direct inward access [.....]
181. Extension metering/temporary trunk barring [.....]
182. Group calls [.....]
    183. All at once.
    184. Sequential hunt group.
    185. Circular hunt group.
    186. Longest idle.
    187. [.....]
188. Hold [.....]
189. Hunt groups [.....]
190. Incoming call identification [.....]
191. Last number redial [.....]
192. Least cost routing [.....]
193. Linked numbering scheme [.....]
194. Manager/secretary working [.....]
195. Music on hold [.....]
196. Night service dial answer [.....]
197. Night service (unattended operation) [.....]
198. Paging [.....]
199. Pick-up groups [.....]
200. Ring group [.....]
201. Room monitor [.....]
202. Three-party connection (conference) [.....]
203. Visually handicapped operators console [.....]
204. voice-mail [.....]
205. [.....]

206. Specialist working
  207. [.....]
208. Hotel
  209. [.....]
210. Call management facilities
  211. Logging of
    212. Incoming calls [.....]
    213. Time to answer incoming calls [.....]
    214. Time on hold of incoming call [.....]
    215. Time for extension answer of incoming call [.....]
    216. Destination of outgoing calls [.....]
    217. Duration of outgoing calls [.....]
    218. Unsuccessful outgoing calls [.....]
    219. Time and date of outgoing calls.
    220. Department of call origination.
    221. Originator extension number.
    222. [.....]
  223. Reporting and calculation of,
    224. All details of all calls.
    225. Totals of outgoing calls.
    226. Totals of incoming calls.
    227. Duration and cost of all calls.
    228. Duration and cost of calls classified by account code [.....]
    229. Duration and cost of calls classified by department.
    230. Duration and cost of calls classified by extension.
    231. Duration and cost of calls classified by tariff band.
    232. Reports printed on demand [.....]
    233. Reports displayed [.....]
    234. Reports transmitted to computer systems [.....]
    235. [.....]
  236. Physical arrangements
    237. Processor [.....]
    238. Display [.....]
    239. Printer [.....]
    240. Keyboard [.....]
    241. Connection to exchange [.....]
    242. [.....]
243. Operator console facilities
  244. Multiple console working.
  245. Number of operators consoles [.....]
  246. Busy out console [.....]
  247. Number of line appearances [.....]
  248. Trunk status display [.....]
  249. Call stacking or queuing [.....]
  250. Queue display [.....]
  251. Call identification [.....]
  252. Call selection [.....]
  253. Extension selection [.....]
  254. Extension status display [.....]
  255. Automatic dialling [.....]
  256. Abbreviated dialling [.....]
  257. Incoming call hold [.....]
  258. Camp on [.....]
  259. Hold and camped-on call display [.....]
  260. Paging access [.....]
  261. Public address access [.....]
  262. Call splitting [.....]
  263. Call splitting on recall [.....]
  264. Call reversion to operator on no answer [.....]
  265. Operator locked out until recall [.....]
  266. Demand working [.....]
  267. Through dialling [.....]

268. Conference set-up [.....]
269. Directory display [.....]
270. Access to message handling [.....]
271. Time and date display [.....]
272. Alarm display [.....]
273. Intercommunication with other consoles [.....]
274. Hand set working [.....]
275. Head set working [.....]
276. Loud speaking [.....]
277. Night service [.....]
278. Record conversation with record tone [.....]
279. Visually Disadvantaged Operator facilities [.....]
280. [.....]

281. Supervisor/management console facilities
282. Facilities as operators console [.....]
283. Trunk busy verification [.....]
284. Extension busy verification [.....]
285. Control of access to trunk groups [.....]
286. Directory update [.....]
287. Number changes [.....]
288. Hunt group set up [.....]
289. Pick-up group set up [.....]
290. Class of service set up and changes [.....]
291. Class of restriction set up and changes [.....]
292. Short dial code library control [.....]
293. Security password control [.....]
294. [.....]

295. Numbering system
296. Extension numbering [.....]
297. DDI numbering [.....]
298. [.....]

299. Physical arrangements
300. Dimensions of operator consoles [.....]
301. Weight of operator consoles [.....]
302. Dimensions of supervisor/management console [.....]
303. Weight of supervisor/management consoles [.....]
304. Distributed processing [.....]
305. Central processor [.....]
306. Dimensions of equipment cabinets [.....]
307. Weight of equipment cabinets [.....]
308. Location of consoles [.....]
309. Location of equipment cabinets [.....]
310. Inter console and equipment cabling [.....]
311. Duplicated processor [.....]
312. Duplicated equipment [.....]
313. Test jack frame [.....]
314. Power supply [.....]
315. Power consumption [.....]
316. [.....]

310.050 TELEPHONES:

Standard

317. Conform to The Radio and Telecommunications Terminal Equipment Regulations 2000 as amended.
318. [.....]

310.060 FACSIMILE MACHINES:

Standard

Conform to The Radio and Telecommunications Terminal Equipment Regulations 2000 as amended.

319. [.....]

320.000 WORKMANSHIP

320.010 WORK ON-SITE:

Ensure that all building works are completed and service connections are provided in accordance with the requirements.
320. By others [.....]
321. [.....]

320.020 QUALITY CONTROL:
Handle store and install all equipment, apparatus and components of the telecommunications system in accordance with BS 6701, BS 7671, and the manufacturer's recommendations.
Inspect all equipment, apparatus and components on delivery, before fixing and after installation and reject and replace any which are defective.
Record all commissioning measurements and tests.
Manage configuration of software, settings, data, and design, in accordance with an appropriate Configuration Management Plan complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC/IEEE 12207 and BS ISO/IEC/IEEE 15288.
Provide configuration details along with the operation and maintenance manual on hand-over.
Manage information
of systems, software and data during design, implementation and commissioning in line with BS ISO/IEC 27001.
Provide certification and test reporting in accordance with BS 6701 and BS 7671 along with the commissioning records, and the operation and maintenance manual on hand-over.

320.030 INSTALLATION:
Install telecommunications systems in accordance with BS 6701, BS 7671, and the manufacturer's recommendations.
322. [.....]

320.060 MEASUREMENT OF TRAFFIC HANDLING CAPACITY:
Measure, calculate and report to the user the peak load traffic levels of components of the system, within the period specified after the system has been put into use.
323. Components
- 324. PBX [.....]
- 325. Tandem exchanges [.....]
- 326. PTO private circuits [.....]
- 327. LAN [.....]
- 328. WLAN [.....]
- 329. VPN [.....]
- 330. Other system links [.....]
- 331. [.....]

332. Period
- 333. One year.
- 334. [.....]

335. Method
- 336. Busy hour traffic recording by power usage
- 337. Busy hour traffic recording by continuous traffic recording.
- 338. [.....]

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W20 – Entertainment Systems

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES

To provide audio and /or visual systems for the transmittal and receipt of information with radio and audio visual equipment.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W20

300.000 GENERAL

Refer to scope of works for project particular requirements.

300.010 RADIO AND AUDIO-VISUAL RECEPTION AND DISTRIBUTION SYSTEM:

Standards

Relevant parts of BS EN 50083, BS EN 60065, and BS EN IEC 62368-1, relevant parts of BS EN 60728 / BS EN IEC 60728 / BS IEC 60728 for cable networks.

Where appropriate, bond all aerials and mountings to the lightning protection system in accordance with BS EN 62305-3 and provide surge protection in accordance with BS EN 62305-4.

Comply with the relevant Confederation of Aerial Industries (CAI) codes of practice.

300.015 SYSTEM OUTPUT SIGNAL LEVELS AND TV PICTURE

Ensure that signal levels at outlets are as recommended by Confederation of Aerial Industries (CAI) and are within the ranges:

Signal Type	Range	
	Minimum	Maximum
Band IV/V analogue TV	60dB$_u$V	80dB$_u$V
Satellite analogue TV IF 0.95GHz to 2.15GHz	47dB$_u$V	77dB$_u$V
Band II FM analogue radio stereo	40dB$_u$V	74dB$_u$V
Band II FM analogue radio mono	40dB$_u$V	74dB$_u$V
Where Band II channel intervals are 300kHz		66dB$_u$V
Band IV/V digital TV	45dB$_u$V	70dB$_u$V
Satellite digital TV IF 0.95GHz to 2.15GHz	52dB$_u$V	77dB$_u$V
Band III DAB	30dB$_u$V	70dB$_u$V

Ensure that TV picture quality on analogue is a minimum of 4 on the CCIR impairment scale.

Ensure that minimum signal to noise ratios are:

Signal Type	Minimum
625 line PAL1 TV	43dB
Band II FM analogue radio stereo	45dB
Band II FM analogue radio mono	25dB

Ensure that minimum carrier to noise ratios are:

Signal Type	Minimum
Terrestrial 625 line PAL1 TV	43dB
Satellite TV	15dB
Band II analogue FM radio stereo	45dB
Band II analogue radio mono	25dB
Terrestrial digital TV	26dB
Satellite digital TV	10dB
Band III DAB	15dB

300.031 ENTERTAINMENT SYSTEMS SPECIALIST:

Engage an entertainment system specialist to develop design, supply, install, commission and set to work a system distributing the specified sound and vision programmes in accordance with BS 6259, BS EN 50083, BS EN 60065 and BS EN 60728

The specialist to be a member company of CAI.

300.050 SOFTWARE:

Obtain on behalf of the end users all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Provide documentation for application software in accordance with BS ISO/IEC 26513 and BS ISO/IEC 26514.
Ensure that, as far as practicable, all software is commercially available off-the-shelf.
Ensure that any programmable configuration, customisation, and bespoke software, is developed, tested and commissioned using relevant processes and procedures complying with BS EN ISO 12207 or BS ISO/IEC/IEEE 15288, supported by a quality management system meeting the requirements of BS EN ISO 9001.

300.070 HOSPITAL RADIO DISTRIBUTION SYSTEM:
Provide radio distribution system integrated with nurse call system to the Bedhead Services Health Technical Memorandum 08-03.

300.080 RADIO RECEPTION AND DISTRIBUTION SYSTEM / SPECIALIST:
Standards
BS 6259, BS EN IEC 62368-1 and BS EN 60065.
Relevant parts of BS EN 50083 and relevant parts of BS EN 60728 / BS EN IEC 60728 / BS IEC 60728.
Engage a radio reception and distribution system specialist to develop design, supply, install, commission and set to work a system distributing sound broadcast programmes in accordance with BS 6259 and BS EN 60065.

300.120 AUDIO-VISUAL SYSTEM SPECIALIST:
Engage an audio-visual system specialist to develop design, supply, install, commission and set to work an audio-visual system in accordance with BS 5817 and BS EN 61938.

300.130 ELECTROMAGNETIC COMPATIBILITY:
Ensure all equipment is compatible, and does not adversely affect, nor is adversely affected by, any other equipment installed in the same location.
Ensure all systems are designed and installed with due consideration to good EMC practice, and in line with EMC requirements of relevant standards including: BS 7671; BS EN 50310; BS EN50174-series.
Ensure all equipment complies with the EMC Regulations (2006), carries the CE Mark, and is suitable for the EM environment in which it is to be used, for the service to which it is to be put.

300.140 DIGITAL CONTROL PROTOCOLS:
Provide interconnecting bus between elements of the audio and video cluster using the domestic digital bus (D2B) in accordance with BS EN 61030. Interconnect the D2B with the home electronic environment:

300.151 INTEGRATED SYSTEM:
Where specified on the Drawings or Schedules, combine with other systems to provide an integrated system.

300.160 THE ENVIRONMENT
Ensure equipment is selected, configured and arranged to minimise the consumption of energy as far as possible.
Ensure equipment complies as necessary with the Ecodesign and Energy Labelling Directives.
Ensure equipment complies as necessary with BS EN 50563 and BS EN 50564.
Provide facilities to configure / schedule timed standby.

310.000 PRODUCTS/MATERIALS
Standards – comply with the following as appropriate to the scope of works
Relevant parts of BS EN 60728 - cable networks
Receivers - BS EN 55013, BS EN 55020, and BS EN 60107
BS EN 50494 – satellite signal distribution
Relevant parts of BS EN 60268, BS 6840, BS EN IEC 60098 for sound systems equipment
Ensure flat panel displays are suitable for mounting in accordance with the Video Electronics Standards Association (VESA) Flat Panel Display Mounting Interface (FDMI) standard.
Comply with Confederation of Aerial Industries (CAI) Codes of Practice.

320.000 WORKMANSHIP

320.010 SYSTEM INSTALLATION:

Install the system and its elements in accordance with the manufacturers recommendations and BS 6259 and where applicable and Confederation of Aerial Industries (CAI) recommendations.
Ensure screens are installed to facilitate compliance with BS 8300 as far as practicable.

320.020 ENTERTAINMENT SYSTEM DEMONSTRATION:
Demonstrate that the entertainment system meets all specified requirements and provides quality and impairment of sound or vision reproduction as required.

320.030 TRAINING:
Train the personnel responsible for operating the Radio and television reception and distribution system and CCTV system.

320.040 AERIAL INSTALLATION:
Install aerials in accordance with Confederation of Aerial Industries (CAI) recommendations.
Bond all aerials and mountings to the lightning protection system in accordance with BS 7671, BS EN 62305 and BS EN 60728-11 according to the lightning protection arrangements of the structure.
Provide surge protection devices for aerial cabling where necessary to comply with BS 7671, BS EN 62305 and BS EN 60728-11.

320.050 CONNECTION TO FEEDER SYSTEM OUTLETS:
Connect radio and television receivers to feeder system outlets in accordance with BS 7587.

320.060 QUALITY CONTROL:
Handle, store and install equipment and components of the radio/TV system in accordance with the manufacturer's recommendations.
Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.
Record all commissioning tests and site modifications to hardware or software, and revise operating and maintenance instructions accordingly.
Manage configuration of software, settings, data, and design, in accordance with an appropriate Configuration Management Plan complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC/IEEE 12207 and BS ISO/IEC/IEEE 15288.
Provide configuration details along with the operation and maintenance manual on hand-over.
Manage information security of systems, software and data during design, implementation and commissioning in line with BS EN ISO/IEC 27001.

10000 NES VERSION W20 TEXT Dec 19

W40 – Access Control

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide systems to control the movement of personnel into defined spaces.
Select and install all equipment to ensure compliance with BS 8300 Parts 1&2 as appropriate (Design of an accessible and inclusive built environment. Buildings. Code of practice).

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W40

300.000 GENERAL
Refer to scope of works for project particular requirements.

300.010 SYSTEM REQUIREMENTS:
Select security detection components and equipment, suitable to meet system objectives requirements.

300.020 ACCESS CONTROL SPECIALIST:
Use an access control specialist for design development, supply, installation and testing and commissioning of the complete access control installation in accordance with BS EN 60839-11-1.
Ensure the specialist is approved by the National Security Inspectorate to carry out the work on the access control system to NSI (National Security Inspectorate) Gold Standard unless detailed otherwise in the scope of work.

300.040 ELECTROMAGNETIC COMPATIBILITY:
Ensure all equipment and systems are designed and installed with due consideration to good EMC practice, and in line with the EMC requirements of relevant standards including BS 7671, BS 4737 series, BS EN 50310, BS EN 50174-1, BS EN 50174-2, and BS EN 50174-3.
Ensure all equipment complies with EMC Regulations, carries the CE Mark, and is suitable for the electromagnetic environment in which it is to be used, for the service to which it is to be put.

300.070 EQUIPMENT:
Provide equipment for operation in the environment specified in the schedule of Common Design Criteria A13sch and/or the scope of work for the particular project.
Ensure components forming part of, and/or controlling electrically controlled exit systems on escape routes comply with BS EN 13637.
Select and install components to ensure compliance with The Equality Act 2010 as amended, and BS 8300 Parts 1&2.

300.080 INTEGRATED SYSTEM:
Where specified on the Drawings, Schedules or scope of works, combine with other systems to provide an integrated system.

Ensure systems and components forming part of, and/or controlling electrically controlled exit systems on escape routes comply with BS EN 13637. Ensure interfaces to the fire detection and alarm system comply as necessary with relevant parts of BS 5839 and BS 7273.

300.090 SOFTWARE:
Obtain on behalf of the end users all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Provide documentation for application software in accordance with BS ISO/IEC 26513 and BS ISO/IEC 26514.
Ensure that, as far as practicable, all software is commercially available off-the-shelf.
Ensure that any programmable configuration, customisation, and bespoke software, is developed, tested and commissioned using relevant processes and procedures complying with BS ISO/IEC/IEEE 12207 or BS ISO/IEC/IEEE 15288, supported by a quality management system meeting the requirements of BS EN ISO 9001.

310.001 PRODUCTS / MATERIALS (NES 310.010 – 310.080)
Refer to the scope of works for project specific equipment / systems.
Select and install components to ensure compliance with The Equality Act 2010 as amended and relevant part of BS 8300.
Standards - as appropriate to the project specific systems, including, but not limited to the following:
Entry phone access system – BS EN 50486

Electrically operated door locks – BS EN 60730-2-12 or BS EN IEC 60730-2-12
Power operated doors / gates
BS EN 12453, BS EN 12604, BS 7036-0, BS EN 16005, BS EN 12635,
BS EN 14637, BS EN 60335-2-95, BS EN 60335-2-103,
Health and Safety Executive Safety Notices FOD WSW 1-2010 and FOD 7-2010, BS EN 12978
Door closers – BS EN 1154
Vehicle parking control equipment – relevant parts of BS 6571
Standby power supplies for controllers
BS EN 50131-6 for intruder alarm and hold-up system specific components.
BS EN 54-4 for power supply equipment where BS 5839-series applies (fire detection and alarm systems for buildings)
BS EN IEC 62485-series for secondary batteries and battery installations.

320.000 WORKMANSHIP

320.010 WORK ON SITE:
Ensure that all building works are completed and service connections are provided.

320.020 INSTALLATION:
Install, commission and set to work equipment in accordance with manufacturer's recommendations and BS 7671.

320.030 QUALITY CONTROL:
Handle, store and install equipment and components of the access control systems in accordance with the manufacturer's recommendations.
Obtain all equipment and components from a single source.
Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.
Record all commissioning measurements and tests.
Manage configuration of software, settings, data, and design, in accordance with an appropriate Configuration Management Plan complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC/IEEE 12207 and BS ISO/IEC/IEEE 15288.
Provide configuration details along with the operation and maintenance manual on hand-over.
Manage information security of systems, software and data during design, implementation and commissioning in line with BS EN ISO/IEC 27001.

10000 NES VERSION W40 TEXT Dec 19

PART 1SYSTEM OBJECTIVES

100.011 PERFORMANCE OBJECTIVES

To provide detection and alarm systems serving to enhance safety and reduce loss by the detection of fire, enabling an audio/visual alarm to be given so that emergency actions may be taken.
The fire alarm system shall provide detection and alarm functions in overall conformity of the premises to BS 9999.
The fire alarm system shall provide detection and alarm functions in overall conformity of residential buildings to BS 9991.

100.020 DESIGN PARAMETERS

Comply with the following as appropriate to the particular project requirements
BS 5839-1 - non domestic premises
BS 5839-6 - domestic premises
BS 5839-8 - emergency voice communications systems
BS 6266 - Fire protection for electronic equipment installations

Voice Alarm Systems

Voice Alarm Systems shall be capable of relaying clear intelligible speech for fire and other alarm messages, in addition to alert and evacuation fire alarm tones, simulating an electronic fire alarm sounder (frequency to be <1,000Hz). The alarm shall be broadcast on a zone by zone basis, or groups of zones, including all zones.

The audibility levels shall be as follows;
Minimum : As recommended in BS 5839-8 and BS EN 50849
Preferred : 70 to 75dB(A)
Maximum : 120dB(A)

A minimum speech intelligibility index (STI) of 0.5 shall be achieved.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W50.

300.000 GENERAL

300.011 TYPE OF SYSTEM:

See scope of works and / or schedules for Type, Detection Category (or Grade for domestic systems) and Voice Alarm Type
Provide means of testing wiring of each zone, detection loop or alarm circuit of system.
Provide means of disabling zones or individual detectors as specified.
Provide a fully monitored system in accordance with the relevant parts of BS 5839 and BS EN 54. Include all end of line and other necessary circuit elements to facilitate monitoring.

Refer to schedules for project particular details

300.015 ELECTROMAGNETIC COMPATIBILITY:

Ensure all equipment is compatible and does not adversely affect, nor is adversely affected by any other equipment installed in the same location.
Ensure all systems are designed and installed with due consideration to good EMC practice and in line with EMC requirements of relevant standards including: BS 7671; BS EN 50310; BS EN 50174-series.
Ensure all equipment complies with the EMC Regulations (2016), carries the CE Mark and is suitable for the EM environment in which it is to be used, for the service to which it is to be put.
Ensure all relevant fire alarm equipment complies with BS EN 50130-4.

300.017 SOFTWARE:

Obtain on behalf of the end users all appropriate licences, permissions, copyright wavers, rights of use etc. from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support

and appropriate updating. Provide documentation for application software in accordance with BS ISO/IEC 26513 and BS ISO/IEC 26514.
Ensure that, as far as practicable, all software is commercially available off-the-shelf.
Ensure that any programmable configuration, customisation and bespoke software is developed, tested and commissioned using relevant processes and procedures complying with BS ISO/IEC/IEEE 12207 or BS ISO/IEC/IEEE 15288, supported by a quality management system meeting the requirements of BS EN ISO 9001.

300.041 CONTROL SYSTEM:
Standard
BS 5839-6 Annex B.
BS EN 54-2
BS EN 54-4
BS EN 54-25 for components using radio links
See Scope of Works and Schedules for type of control system.

300.045 VOICE ALARM SYSTEM
Standard
BS EN 54-16
BS 5839-8
BS 6259 as appropriate (planning, installation, testing and maintenance of sound systems)
Connection to Fire Alarm System in accordance with relevant parts of BS 5839.
Intelligibility of speech messages of sound system equipment to BS EN 60268-16.
Unless specified otherwise the voice alarm system shall transmit a common 'Voice alarm system fault', particular to each voice alarm rack, for any fault condition, which may occur within each voice alarm system.
Emergency sound system at sports venues to BS 7827

300.046 EMERGENCY VOICE COMMUNICATION (EVC) SYSTEM
Standard - BS 5839-9
Access for maintenance / software programming to BS EN 54-2.

300.050 EXPLOSIVE OR FLAMMABLE ATMOSPHERES:
Where fire alarm equipment or wiring is installed in areas where explosive or flammable atmospheres occur comply with BS EN IEC 60079 /BS EN 60079.

300.081 REMOVAL OF TRIGGER DEVICE:
Provide precautions against removal of trigger devices.
Use trigger devices that are removed only by a special tool.
Use trigger devices with bases that provide circuit continuity with trigger device removed.
Ensure that, where alarm sounders use same wiring as trigger device, removal of trigger device does not affect operation of alarm sounder.

300.100 REMOTE CENTRE:
Make provision to send signal to remote centre where specified.

300.110 FIRE ALARM SPECIALIST:
Engage a specialist to develop the design, supply, install, commission and set to work the fire alarm system.

300.115 VOICE ALARM SYSTEM SPECIALIST:
The Fire Detection and Alarm Specialist shall engage a Public Address and Sound Amplification Specialist to develop design, supply, install, commission and set to work a voice alarm and sound distribution system in accordance with BS 5839-8, BS EN 60849 and BS 6259.

300.120 INTEGRATED SYSTEM
Where specified on the Drawings or Schedules, combine with other systems to provide an integrated system.
Security detection and alarm / social alarm in dwellings in accordance with clause 9.1.5 of BS 5839-6.
Ensure interfaces comply as necessary with relevant parts of BS 5839 and BS 7273.

310.000 PRODUCTS/MATERIALS

310.011 MANUAL CALL POINTS:
Standard
BS EN 54-11
Mounting as scheduled

Degree of Protection to BS EN 60529 as scheduled
Operation
Manual Call Point activation response within 3 seconds.
Manual operation
Key switch.
Break glass with anti-fragmentation film.
Thumb pressure

310.021 AUTOMATIC DETECTORS
Provide automatic fire detectors from the same manufacturers and with common facilities.

Plug in bases.
Common base for all detector types.
Visible activation indicator.
Visible remote indication for detectors concealed in roof spaces etc.
Label detector bases with address number (where static addressing is used)
Mount detectors in floor voids on brackets to facilitate proper functioning of these detectors.

Position detectors in accordance with BS 5839 to take account of air movement

For combined sounder/sensors, removal of sensor not to inhibit sounder.

310.031 HEAT DETECTORS:
Standard
Point type BS 5446-2 - heat alarms for dwellings
BS EN 54-5 - heat detectors

Line type BS EN 54-28 - non-resettable line-type heat detectors
310.041 SMOKE DETECTORS:
Standard
Point type
BS EN 14604 (Residential applications)
BS EN 54-7 - using scattered light, transmitted light or ionization
BS ISO 7240-15 - using smoke and heat sensors
Aspirating type
BS EN 54-20
Optical beam type
BS EN 54-12

310.051 RADIATION (FLAME) DETECTORS:
Standard
Point type
BS EN 54-10

Characteristics as scheduled.

310.061 MULTI-SENSOR FIRE DETECTORS:

Standard

Point detectors with a combination of smoke and heat sensors: BS EN 54-29

Point detectors with a combination of carbon monoxide and heat sensors:

BS EN 54-30

BS ISO 7240-8

Point detectors using a combination of smoke and carbon monoxide, and optionally heat sensors: BS EN 54-31

Carbon monoxide fire detectors to use an electro-chemical cell in combination with a heat sensor.

310.071 SOUNDERS:

Standard

Comply with BS 8456 - code of practice for design and installation of directional sounder evacuation systems

BS EN 54-3

310.081 FIRE ALARM CONTROL AND INDICATING EQUIPMENT (CIE):

Standard

BS 5839-1 and BS EN 54-4

BS 5839-6 Annex B (Residential applications).

BS EN 54-2

Functional requirements

Standard functions and additional functions as scheduled.

310.083 SLAVE STATUS UNITS (EXTINGUISHING SYSTEMS):

Refer to work section S70, S71 or S72 / relevant schedules for extinguishant system details.

Install slave status units outside all secondary exits or entrances to the protected area(s).

Ensure each panel houses a four-way status indicator with the visual indication the same as extinguishant control unit.

Ensure each panel is complete with a key-switch for mode selection and break glass push button manual release call point.

Ensure they are wired for priority enabling key-switch selection to be repeated at the other units, system isolated to have priority manual, which in turn has priority over automatic mode.

310.085 VOLT FREE CONTACTS (EXTINGUISHING SYSTEM CIE):

Refer to work section S70, S71 or S72 / relevant schedules for extinguishant system details.

Include in the Extinguishant Control Panel all necessary volt free change-over contacts all rated at one amp.

First coincidence contacts are required for:

- Signal to main fire alarm panel.
- Signal to B.M.S.
- Shut off fans and close smoke dampers
- Shut down air handling units.

Second coincidence contacts are required for:

- Signal to main fire alarm panel.
- Signal to B.M.S.
- Shut off fans and close smoke dampers
- Shut down air handling units.
- Emergency power off electrical supply system.

Additional contacts are required for

- Gas extinguishant released / sprinkler system filled with water, as appropriate.
- Common fault condition signal to the main fire alarm panel.

310.086 HOLD OFF FACILITY (EXTINGUISHING SYSTEMS):

Refer to work section S70, S71 or S72 / relevant schedules for extinguishant system details.

Install 'Hold Off' facilities at all exits from within each protected room(s).

Ensure that the operation of any hold off unit will stop the pre-charge timer and isolate the second stage sounders and reset the timer to zero which is to be maintained whilst the button is depressed.

Release of the button will reinstate the timer cycle delay for the full 30 seconds. This facility must be capable of being repeated multi-shot.

310.091 REPEATER PANEL:
Standard
BS EN 54-2
BS EN 54-4

310.101 MIMIC PANEL:
Standard
BS EN 54-2

310.110 ANCILLARY SERVICES CONTROL:
Make provision to open or close circuits of ancillary services by means of relay or similar device as scheduled.
Standard
BS EN 54-2

310.115 INPUT/OUTPUT DEVICES
Standard
BS EN 54-18

310.121 POWER SUPPLIES:
Standard
BS 5839-1
BS EN 54-4

310.131 REMOTE INDICATOR MODULE
Standard
BS EN 54-2

310.141 LINE ISOLATOR MODULE
Standard
BS EN 54-2

310.145 SHORT CIRCUIT ISOLATORS
Standard
BS EN 54-17

310.151 VISIBLE ALARMS:
Standard
BS EN 54-2
BS EN 54-23

310.161 ZONE MONITORING UNIT:
Standard
BS EN 54-2

310.171 AUTOMATIC RELEASE MECHANISM:
Standard
BS 5839-3
BS 7273-4 - actuation of release mechanism for doors
BS EN 14637 - electrically controlled hold-open systems for fire/smoke door assemblies.

310.191 VOICE ALARM LOUDSPEAKERS:
Standard
BS 5839-8
BS EN 54-16
BS EN 54-24
Speakers used in conjunction with voice alarm systems shall suit the functional surveillance method employed, each loudspeaker shall be fitted with a capacitor to block dc signals.

Voice alarm circuit wiring shall be glanded directly into the speaker enclosure and terminated into a terminal block fixed to the enclosure. Separate terminals shall be provided to allow the incoming and outgoing conductors to be terminated independently. Terminals shall be suitable for a maximum conductor size of 2.5mm^2. A flying lead shall be provided between the incoming / outgoing cable terminal box and the speaker assembly terminal block.

Speaker tapings shall be pre-wired to a 'fixed' terminal block, mounted to the speaker assembly. The terminal block shall be provided with 'links' to allow the speaker output tapping to be changed.

310.201 VOICE ALARM MICROPHONES :
Standard
BS 5839-8
BS EN 54-16

310.211 VOICE ALARM MESSAGE GENERATORS:
Standard
BS 5839-8
BS EN 54-16
Level range -3dB 200 Hz to 5.5 Hz.

310.221 VOICE ALARM AND INDICATING CONTROL EQUIPMENT:
Standard
BS 5839-8
BS EN 54-16

Functional requirements
Reception, control and relaying of signals from fire detection and alarm systems and fire microphones.
Indication, warning of signals and system statuses.
Generation, amplification and distribution of messages to loudspeakers.

310.231 VOICE ALARM POWER SUPPLIES:
Standard
BS 5839-8
BS EN 54-4
BS EN 54-16

310.241 EMERGENCY VOICE COMMUNICATION MASTER STATIONS:
Standard
BS 5839-9

310.251 EMERGENCY VOICE COMMUNICATION OUT STATIONS:
Standard
BS 5839-9

310.261 EMERGENCY VOICE COMMUNICATION SYSTEM POWER SUPPLIES:
Standard
BS 5839-9

310.271 RADIO FIRE DETECTION AND ALARM SYSTEMS
Ensure all components using radio links comply with BS EN 54-25.

320.000 WORKMANSHIP

320.010 QUALITY CONTROL:
Handle, store and install equipment and components of the fire detection and alarm system in accordance with BS 5839 and the manufacturer's recommendations.
Obtain all equipment and components from a single source.
Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.

Record all commissioning tests and provide the certification required by BS 5839-1.
Provide manufacturers certificates of equipment design to an approved quality management system and CIE component selection.
Record all commissioning measurements and tests, site modifications to hardware or software, and revise operating and maintenance instructions accordingly.
Manage configuration of software, settings, data and design, in accordance with an appropriate Configuration Management Plan complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC/IEEE 12207 and BS ISO/IEC/IEEE 15288.
Provide configuration details along with the operation and maintenance manual on hand-over.
Manage information security of systems, software and data during design, implementation and commissioning in line with BS EN ISO/IEC 27001.

320.020 SMOKE DETECTOR INDICATORS:
Fit smoke detector indicators external to doors, where zone is divided into rooms.

320.031 MANUAL CALL POINTS:
Wire manual call points to initiate zone alarms as indicated on drawings

320.041 RECORD DRAWINGS AND OPERATING INSTRUCTIONS:
Provide instructions on use of installation to person responsible for use of premises. Supply the user with a logbook and certificate of installation and commissioning in accordance with BS 5839-1, Appendix F and G.
Provide record drawings for maintenance and record purposes, showing locations of equipment and accessories, sizes and routes of cables, and connection diagrams for junction boxes and distribution cases.
Provide circuit diagrams of fire alarm system and its components.

320.050 CABLE INSTALLATION:
Plan and install all fire detection and alarm system cables in accordance with BS 5839-1 and the cable manufacturer's recommendations.
Run cables point to point without tees or spurs.
Design loop load (current and device count) not to exceed 80% of cable / loop capacity.
Mark all terminals with polarity and loop / circuit reference.

10000 NES VERSION W50 TEXT Dec 19

Incorporates Y80 (Earthing and Bonding Components)

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES

To provide systems for the transfer of electric current to earth, to protect personnel, buildings, structure, plant and equipment in the case of an electrical fault within the supply system and from interference from electro-magnetic fields and electro-static forces.

300.000 PART 3 SPECIFICATION CLAUSES SPECIFIC TO W51

300.010 STANDARDS

As defined in the scope of works, carry out or complete the design, installation, inspection and testing of an earthing and bonding system for the low voltage electrical installation in accordance with Electricity Safety, Quality and Continuity Regulations 2002, Electricity at Work Regulations 1989, BS 7671, BS 7430 and local Distribution Network Operator (DNO) requirements.

Confirm with the DNO that, in the event of a fault in the high voltage network, the resulting transfer Earth Potential Rise (EPR) to the low voltage electrical installation can be achieved at a safe level. If the safe level cannot be met, control measures should be provided to eliminate risk of injury.

Ensure the potential rise in telecommunications circuits due to power system earth faults is limited, as per BS 6701

For requirements of separate or combined high voltage and low voltage electrical installation earthing, see W56.

For functional requirements of information technology and telecommunication systems, to be installed within the building (now or in the future), see BS EN 50174-1, BS EN 50174-2 or BS EN 50174-3 and BS EN 50310.

Ensure that the integrity of the structural steelwork will not be subject to any detrimental influences by any stray DC current flowing in the earthing and bonding system or suitable measures have been taken to avoid it.

300.030 PME INSTALLATIONS:

Provide protective conductors for TN-C-S (PME) Systems where specified

300.032 COMMON BONDING NETWORK (CBN):

Where appropriate, form a Common Bonding Network for information technology equipment by equipotential bonding of metalwork throughout the building. Carry out work to the Common Bonding Network in accordance with BS 7671, BS EN 50174-1, BS EN 50174-2 or BS EN 50174-3 and BS EN 50310. Include in the CBN but not limited to

- Steel structural frames.
- Reinforcement bars in concrete.
- Metallic roof coverings.
- Ceiling grids.
  - Services
  - Dry risers.
  - Water pipes.
  - Air ductlines.
  - Gas services.
  - Power cable containment

300.034 USE OF BUILDING ELEMENTS:

Ensure that building and structural elements used as items in or bonded to the Common Bonding Network are designed and erected in accordance with BS EN 50174-1, BS EN 50174-2 or BS EN 50174-3 and BS EN 50310 as well as their appropriate constructional specification or code of practice. Ensure that all connections to building and structural elements are waterproof and corrosion protected to a degree appropriate to their exposure. A risk assessment on detrimental influence in weather and corrosion protection would be required.

300.036 MESH-BONDING NETWORK (MESH-BN)

Where appropriate, carry out work to achieve a MESH-BN in accordance with BS EN 50174-1, BS EN 50174-2 or BS EN 50174-3 and BS EN 50310.

Form MESH-BNs in areas indicated on the drawings or detailed in the scope of works

300.040 EXISTING INSTALLATIONS:

Check earth continuity conductors and loop impedance values of existing installation. Report defects and elements not in accordance with BS 7671 (IET Regulations) before connecting new or modified installations to existing supply.

300.050 SOIL TESTS:
Where specified carry out soil tests in accordance with BS 1377 to establish soil electrical resistivity and soil analysis as required.
Apply one or more acceptable industry practice testing method to carry out soil resistivity tests in accordance with the requirements of BS 7430.

300.060 RISE IN POTENTIAL IN TELECOMMUNICATIONS CIRCUITS:
Ensure the potential rise in telecommunications circuits due to power system earth faults is limited, as BS 6701.

300.070 EXCHANGE OF INFORMATION:
Consult with the electricity supply company regarding the earthing arrangements of the installation. Construct the earthing system to the requirements of BS 7430 and BS 7671 /electricity supply company. Ensure any part of the earth fault current path provided by the electricity supply company or others is suitable for the operation of the earth fault protection to be installed. Obtain the agreement and permission of undertakings providing services which are to be bonded to the earthing system.

300.081 EARTH FAULT RELAYS:
Ensure system compatible with earth fault relays on electrical system as specified elsewhere.

310.000 PRODUCTS AND MATERIALS

310.010 CLEAN (LOW NOISE) EARTH DISTRIBUTION (Y80 3010)
Install clean earth distribution in double insulated cables from earth electrodes to equipment points. Mount all busbars with insulators and separately from other earthing systems.

310.020 MAIN EARTH TERMINAL:
Provide earth bar at incoming electrical service position, for each switchboard.
Bond earth terminals and metallic structure of switch and control gear and plant.
Connect each earth terminal to all other earth terminals by a ring conductor sized as BS 7430 and BS 7671.
Location
Adjacent to main switch panel.
Mounting
Mount earth bar on insulated supports located at 300mm centres for 25mm bar and 450mm centres for 50mm bar, giving 50mm clearance at rear of bar.
Material
Manufacture earth busbars from hard drawn, high conductivity copper bar.
Substation Earth busbar
75 x 13mm cross section 600mm minimum length.
Building Earth bar
25 x 6 mm minimum for incoming live conductor not exceeding 50mm2 and 50 x 6 mm minimum for incoming live conductor over 50mm2.
Drill clearance holes, one for each cable plus 30% spare holes (two minimum) at 50mm minimum centres through bar for connection of cable lugs. Ensure clearance holes are minimum necessary size to maintain adequate lug/bar contact.
Size the MET and protective earthing conductors in accordance with BS 7671

310.030 MAIN EARTH TERMINAL CONNECTIONS / SUBSTATION EARTH BAR:
Connect separately each main earth conductor and main equipotential bonding conductor to main earth terminals.
Terminate circuit protective conductors on switchboard earthing bar.
Terminate conductors with compression type lugs suitable for bolting direct to bar or solder lugs suitable for bolting direct to bar
Extend separate protective conductor from main earth terminal to main switch/switch panel served by incoming main cable or
When main cable is provided by Electrical Supply Company, extend separate protective conductor from Main Cable armouring gland or direct earth terminals or PME earth installed by supply Company to main earth terminal.
Provide terminations on each Substation main earth bar as appropriate for

HV Switchgear frame earth (bare copper tape).
LV Switchgear frame earth (bare copper tape).
Transformer frame earths (bare copper tape).
Transformer neutral earths (insulated copper cable).
LV Switchboard neutral busbars (insulated copper cable).
Earthing conductor to minimum 2 groups of electrodes.

Connect telecommunications and data equipment in accordance with BS 6701.

310.060 NEUTRAL/EARTH CONNECTION:

Provide earth leakage protection system and position neutral/earth connection at main switchboard unless otherwise indicated.

310.070 CLEAN (LOW NOISE) EARTH BAR:

Where specified provide clean earth bar.

Mounting

Mount earth bar on insulated supports located at 300mm centres for 25mm bar and 450mm centres for 50mm bar, giving 50mm clearance at rear of bar.

Material

Manufacture earth busbars from hard drawn, high conductivity copper bar.

Drill clearance holes, one for each cable plus 30% spare holes (two minimum) at 50mm minimum centres through bar for connection of cable lugs. Ensure clearance holes are minimum necessary size to maintain adequate lug/bar contact.

Terminations

Connect each conductor and tape separately to earth bar.

Connect telecommunications and data equipment in accordance with BS 6701.

310.075 PARALLEL EARTH CONDUCTORS (PEC):

Where specified elsewhere in this specification provide parallel earth conductors to all information technology cable routes in accordance with BS EN 50174-2.

310.080 TRANSFORMER OR GENERATOR EARTH ELECTRODE SYSTEMS:

Provide separate electrode systems which each low voltage generator or transformer to achieve an earth electrode resistance that is as low as practicable. The earth electrode system for LV transformers or generators not interconnected with HV systems shall be designed to achieve a target resistance of 10Ω (but not exceeding 20Ω) in accordance with BS 7430, with separate main earthing conductors for each transformer or generator, and an additional spare electrode system for test purposes.

Where a common HV/LV earthing system is provided, the combined earthing system shall ensure the stress voltage and touch voltage requirements of BS EN 61936-1, BS EN 50522 (including National Annex NA.2) and BS 7671 are met in respect of the earthing arrangement(s) of LV system(s) to be supplied. Bond all electrode systems together using a ring conductor. Connect electrode systems to ring conductor via links or disconnecting joints for test purposes.

310.090 INSULATED ISLAND GLANDS:

On cables to switchboards provide insulated island glands to facilitate testing.

310.100 MICS CABLE TERMINATIONS:

Provide manufacturer's seals incorporating protective conductors at each termination, where glands are used or not, and connect conductors to conduit box, adaptable box or equipment box earth terminals.

310.110 FRAME EARTH LEAKAGE:

Where frame earth leakage devices are used for phase to earth protection, connect two earthing conductors as BS 7430, one to the framework of the switchgear and main earth bar via current transformer or other devices, the other to cable sheaths and earthing devices, insulated where necessary.

310.120 PORTABLE EARTH CONNECTIONS:

Provide tape loops for the connection of portable earths where appropriate

310.130 CEILING SUPPORTS:

Bond main supports to exposed conductive parts of electrical installation where appropriate (based on risk assessment).

Holes

Drill or punch holes in main supports in positions indicated to receive terminal screws.

Use holes in main supports for terminal screws.

Terminals

Connect bonding conductors to supports through holes with tinned copper cable lugs or tags secured to support with brass screws, washers, nuts and locking device.

Connection

Connect bonding conductors to supplementary bonding conductors in cable trunking:

Using crimp type connectors.

Include ceiling supports in CBN.

310.135 RAISED FLOOR SUPPORTS:

Bond main supports by extraneous conductive parts where appropriate (based on risk assessment).

Holes

Drill or punch holes in mains supports in positions indicated to receive terminal screws.

Use holes in main supports for terminal screws.

Terminals

Connect bonding conductors to supports through holes with tinned copper cable lugs or tags secured to support with brass screws, washers, nuts and locking device.

Connection

Connect bonding conductors to supplementary bonding conductors in cable trunking

Using crimp type connectors

Include floor and floor supports, in accordance with BS EN 50174-2, in

CBN.

MESH-BN

310.140 SAFETY EARTHING:

Provide safety earthing in accordance with BS 6626, and HSE guides INDG 372 & HSG 230

310.150 TELECOMMUNICATIONS FUNCTIONAL EARTH:

Provide functional earth in accordance with BS 6701 and BS EN 50310.

All cables shall be cream and labelled with telecommunication functional earth.

310.210 CONDUCTORS: (Y80 2010)

Use earthing conductor-Minimum dimension to BS 7430, BS EN IEC 62561-2 Table 1

Current density 50A/mm^2.

Form Strip generally or rod.

Stranded conductor where appropriate

Material

Copper

Use Aluminium only where agreed with Contract Administrator

Coverings

Generally none.

Use LS0H or where thermoplastic wiring systems are employed PVC may be used. Colour as indicated where specified

Accessories

Use proprietary cast gun metal accessories, fixings, clamps and couplings with phosphor-bronze bolts, nuts and washers. Use adhesive fixings only when approved by Contract Administrator.

310.220 CONDUCTOR JOINTS: (Y80 2020, 3040)

Provide waterproof protection at joints subject to moisture.

Joint copper tapes by

tinning before assembly and riveting with two minimum copper rivets. Overlap straight joints by length equivalent to twice (minimum) tape width. Overlap both sides of main tape at tee joints or naval brass bolts or copper rivets (two minimum) and sweat solid whole joint or

Brazing, using zinc-free brazing metal with melting point at least 600^{o}C or

Thermic welding or

Cold pressure welding.

Joint aluminium tapes by

Welding to BS EN 1011-4

Joint circular rods as tapes using through coupler.

Joint stranded conductors with compression joints to BS EN 61238-1.

For bolted connections use crimp type lugs compressed by automatic tool to achieve correct pressure and crimp depth.

Use phosphor bronze bolts, nuts and washers to make connections between conductors and equipment

310.230 **TAPE FIXING DEVICES:** (Y80 2030)

Standard - BS EN 62561-4 for lighting protection system conductor fasteners.

Secure bare copper tape to structure with corrosion resistant proprietary fixing devices which avoid piercing tape and ensure 3mm (minimum) clearance of tape from structure. Space fixings at 450 mm maximum centres for vertical conductors, 1,000mm for horizontal.

310.240 **EARTH ELECTRODES:** (Y80 2040A-E)

Standards as appropriate to the particular specification:

BS 7430 and BS 7671 (IET Wiring Regulations).

Relevant parts of BS EN 62305 where a lightning protection system is present.

BS EN IEC 62561-2 for lightning protection earth electrodes

Material, minimum size as BS 7430, BS EN IEC 62561-2

Form /types as described in the scope of works

Rods - use high tensile strength steel cored molecularly bonded copper sheathed rods with threads rolled on to rods. Sheath thickness 0.25mm (minimum).

Rod Diameter - 15 mm – nominal

Building or structural element earth electrodes

Foundation earth electrodes

Earth electrode couplings

Use silicon bronze alloy, counter bored to completely enclose rod threads. Ensure rods meet in centres of coupling.

Use high strength driving cap in contact with driven rod.

Strip.

Stranded conductor.

Plates - Proprietary item.

Earth electrode tape

Interconnect electrodes using bare copper tape or stranded copper cables.

Location

Locate electrodes not less than 2m distant from building/structure protected, and away from telecommunication and pilot cables and metallic fences.

Barriers

Provide permanent non-conducting barriers to BS 7430 at 2m radius around any electrode liable to produce a voltage gradient of more than,

(V/m) as indicated.

Driving

Drive rods vertically into ground with purpose designed electric hammer. (Where impenetrable strata encountered at shallow depth, drive at 30^{o} to horizontal).

Depth of rod

2.4 m (2 x 1.2) minimum below finished ground surface.

Depth of Electrode heads

Locate electrode heads just below ground level.

Spacing

Where electrodes are installed in a group ensure minimum distance between electrodes is twice depth of rods. Where rods for 'clean' earth are installed ensure distance from any other system rods is six times depth of 'clean' rods.

Tape Depth

Install interconnecting or electrode tape 750mm below finished ground level or as ground conditions allow, rising vertically at each electrode.

Connect groups of electrodes to main earth conductor via bolted link in inspection pit as BS 7430 for test purposes.

Earth electrodes in draw pits

Provide concrete cover, permanently labelled, for electrodes installed through cable draw pit bases

Main earth conductor cover tiles

Provide plastic identification tape over complete external lengths of main earth conductors.

Permanent test electrodes

Provide permanently located test electrodes where indicated

General

Ensure that materials and dimensions of earth electrodes have adequate mechanical strength and are selected to withstand corrosion such that the mechanical integrity of the structural element is not impaired, and the possible increase in earth electrode resistance is minimised.

Where an earth electrode consists of parts that must be connected together, ensure connections are made by welding, pressure connectors, clamps or other suitable mechanical connectors.

Ensure earth electrodes intended to minimise touch voltage, to exposed-conductive-parts and extraneous-conductive-parts, in the event of a broken protective earth and neutral (PEN) conductor in the public supply network, are designed with consideration of, as a minimum, the likely loads in the installation, the relevant network conditions, and the design guidance in IET Guidance Note 5: Protection Against Electric Shock.

310.245 SOIL CONDITIONING AGENT (Y80 2040)

Provide soil conditioning agent only where design indicates necessary

Conditioning agent to be suitable for application.

310.250 EARTH ELECTRODES FOR CATHODICALLY PROTECTED STRUCTURES: (Y80 2050)

Provide earth electrode for cathodically protected structures to BS EN 13636 for buried metallic tanks and related piping and BS EN 15112 for well casings as indicated.

310.260 EARTH ELECTRODE CLAMPS: (Y80 2060)

Connect conductor to electrode head using heavy duty purpose made silicon aluminium bronze body connector clamps or leaded gunmetal body connector clamps, and high tensile phosphor bronze bolts.

Standard BS EN 12163

310.271 EARTH ELECTRODE INSPECTION FACILITIES: (Y80 2070, 2080)

Provide enclosure for each connection between earth conductor and associated earth electrode system. Install so that top of removable inspection cover is flush with finished ground or floor level. For internal locations where the electrode passes through water retaining structure provide puddle flange and sealing gland to BS EN 62561-5 suitable for anticipated water pressure, to prevent moisture penetration and duct from enclosure to adjacent wall for conductor. Ensure enclosure provides adequate access for testing purposes. Inscribe cover with legend `EARTH'.

Provide pit details for builder's work.

After installation of electrode drain all water from pit.

Use concrete, galvanised steel embedded in concrete or polycarbonate as indicated on drawings. Cover to suitable for anticipated loading and to accept finish, where applicable.

310.272 BUILDING ELEMENTS:

Ensure reinforcing bars are in good electrical contact by welding, unless otherwise indicated on the drawings.

310.310 CIRCUIT PROTECTIVE CONDUCTORS: (Y80 2110)

Material as appropriate

Insulated cable

Use LS0H insulated single core cables or

PVC single core cables (where thermoplastic wiring systems are employed)

XLPE Single core to BS 7211.

Metallic screwed conduits (excluding flexible).

Metallic trunking with tinned copper links.

Armouring and/or metallic sheathing of armoured cables.

Armouring of armoured cables where armouring includes copper strands to improve earth conductance.

Integral conductor of multi-core cable.

Size Provide protective conductors sized in accordance with BS 7671 (IET Regulations) 543.1.4 and Table 54.7 or as indicated.

310.320 EARTHING CLAMPS:
Use clamps complying with BS 951, for bonding pipes and lead sheathed cables.

310.340 TEST LINKS: (Y80 2140)
Provide two test links, in connections between main earth conductors and earth busbar. Fabricate each from two additional sections of earth busbar. Mount one section on stand-off insulators matching earth busbar; use remaining section as removable test link. Secure 12mm high tensile brass studs to fixed sections of busbar and drill corresponding clearance holes in test links and provide brass washers, nuts and locking devices to secure frame/neutral earthing and test links.

310.350 LUGS/TAGS: (Y80 2150)
Provide lugs or tags to enable connection of bonding conductors to equipment earth terminals.

310.361 PROTECTIVE CABLE TERMINATIONS: (Y80 2160, 3030 and 3040)
For bolted connections use crimp type lugs compressed by automatic tool to achieve correct pressure and crimp depth.
Make connections between tape and equipment using high tensile grade brass bolts with brass nuts, washers and locking devices or phosphor bronze bolts, nuts and washers where connections are liable to corrosion.
Provide waterproof protection at joints subject to moisture. Joint stranded conductors with compression joints to BS EN 61238.

310.380 MAIN EARTH CONDUCTOR – WARNING TAPES: (Y80 2180)
Provide green/yellow PVC tapes labelled "EARTHING CONDUCTOR" over complete external lengths of main earth conductors at 300mm depth below finished ground.

320.000 WORKMANSHIP

320.010 INSTALLATION OF EARTHING SYSTEM:
Carry out installation of earthing system in accordance with BS 7671 (IEE Regulations), BS 7430 and BS EN 50310.

320.015 DISSIMILAR METALS: (Y80 3020)
Ensure, where dissimilar metals are used for system, that purpose made jointing materials are used such that corrosion and deterioration of the electrical connection are not caused. Ensure bonding connections to other metal parts of building are electrolytically compatible with those metal parts. Use the following guidance when earthing and bonding connections comprise dissimilar materials.
BS 7430 Table 9.
BS EN 62368-1 Annex N.

320.020 WORK ON SITE:
Ensure that all building works are completed and service connections are provided,

320.030 QUALITY CONTROL:
Handle, store and install all equipment and components of the earthing system in accordance with the manufacturers recommendations.
Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.
Test and commission the system in accordance with BS 7430, BS 7671 and BS EN 50310 and as specified elsewhere in the scope of works. Record all test measurements.

320.040 MAIN AND SUPPLEMENTARY PROTECTIVE BONDING:
Bond to main earth terminal all extraneous-conductive-parts of the installation in accordance with BS 7430, BS 7671, BS EN 50310 and relevant parts of BS EN 50174, and BS EN 62305 as appropriate.
Ensure that any of the following services are bonded for each building or equipotential zone:-
Water installation pipes.
Gas installation pipes.
Fuel oil installation pipes.

Air ductlines.
Heating pipework.
Chilled water pipework.
Exposed metallic structural parts of the building.
Lightning protection systems
The metallic sheath of telecommunications cables entering the building.

Connection of the lightning protection system to the protective equipotential bonding system shall be made in accordance with BS EN 62305.
The consent of the owner / operator of telecommunications services shall be obtained prior to making connections to metallic sheaths of cables.
In locations that supplementary equipotential bonding is specified bond all simultaneously-accessible exposed-conductive-parts of fixed equipment and extraneous-conductive-parts in accordance with BS 7671 as applicable.
Bond bathrooms and shower rooms to BS 7671, Section 701.
Extraneous-conductive-parts may be used as supplementary bonding conductors where they satisfy BS 7671
Bond to non-current carrying parts of electrical installation in associated spaces to BS 7430.
Use strip or stranded conductor as appropriate.
Use clamps to BS 951 for bonding of pipes.

320.060 LOW VOLTAGE SHEATHS AND ARMOUR:
Bond the sheaths and armour of low voltage cables solidly to earth at both ends unless otherwise indicated in accordance with BS 7671 and BS 7430.

320.070 METALLIC FENCING:
Bond to earth any metallic fencing enclosing earth electrical system in accordance with BS 7430.

320.080 IDENTIFICATION: (includes Y80 2170 and Y80 2190)
Ensure the function of each protective and functional earthing and bonding conductor is identifiable at its termination points.
Use an appropriate cable marking system, to mark conductors in accordance with the cable schedule.
For circuit protective conductors:
Use numbered and/or lettered plastic cable sleeves to indicate circuit numbers and phases of corresponding phase conductors.
Ensure conductors are connected to earth bar in same sequence as phase and neutral conductors.

Identify at substation, switchboard and building earth bars each protective, bonding and earthing conductor to appropriately identify the function of the conductor.
Label earth bar "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE" with wall mounted laminated plastic tablet engraved in 10mm high red letters on white ground.
Provide a permanent label durably marked in letters 4.75mm minimum height "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE", in visible position, at each bonding conductor connection to extraneous conductive parts.

320.090 GENERATORS:
Provide separate earth electrode system, completely independent of supply earth system where incoming supply is not derived from Consumer's own transformers.
Connect star point of generator to earth electrode system as generator manufacturer's recommendations and to BS 7430.
Bond generator star point and metal framework to Local Electricity Supply Company earthing point.

320.100 EARTHING OF MOBILE GENERATOR:
Bond the generator frame, all exposed metalwork, underframe or chassis and all protective conductors, to BS 7430, to form common reference point. Connect generator star point to this common reference. Provide a separate connection from this reference to the load by a fifth cable core or separate single cable.

320.110 EARTHING OF LV/LV TRANSFORMERS:
Earth transformers in accordance with BS 7671 and BS 7430.
Connect the neutral of the LV/LV transformer to one point only. Use the transformer star point if the system is 3-phase. Earth neutral as detailed in the scope of works or on the drawings

320.120 EARTHING OF MOBILE UNITS OR TRANSPORTABLE PLANT:
Install earthing of mobile or transportable units to BS 7671, Section 717 and BS 7430.
Comply with manufacturer's instructions, and BS 7430, for the earthing of mobile and transportable units with on-board generators, including static inverters.
Earth the source via a liquid resistor to limit the rise in potential of the plant to 50V under earth fault conditions. Use screen and armour of trailing and fixed cables as earth path from plant to source. Ensure all cabling and switchgear is suitable for impedance - earthed systems.

320.130 EARTHING OF CONSTRUCTION SITE ELECTRICAL SYSTEMS:
Earth construction site electrical systems to BS 7430, BS 4363 and BS 7375 and BS 7671 Section 704.

320.140 EARTHING OF CARAVAN PARK ELECTRICAL SYSTEMS:
On appropriate projects, install earthing of caravan park electrical systems to BS 7671, Section 708. Do not extend a PME or TN-C-S system to a caravan supply socket outlet.
For caravans supplied by a TN-S system use high integrity circuit protective conductors for the supply to caravan supply socket outlet.
High Integrity CPC type - Duplicated

320.150 EARTHING OF MARINA ELECTRICAL SYSTEMS:
On appropriate projects, install earthing of marina electrical systems to BS 7671, Section 709. Ensure all conductors subject to tidal and wave movement are arranged and of materials to avoid the deleterious effects of that movement. Do not extend a PME or TN-C-S system to a boat supply socket outlet. Do not use any aluminium or mineral insulated metallic clad cables as protective conductors. Use no joints in protective conductors except at properly protected enclosures. Bond all metalwork on pontoons or landings which may come into contact with the electrical system to the system protective conductor. Provide fuelling point bonding conductors and connection to the system protective conductor so that boats may be bonded before a fuel connection is made, and disconnected after the fuel connection is broken.

320.155 EARTHING OF ELECTRICAL SYSTEMS FOR ONSHORE UNITS OF ELECTRICAL SHORE CONNECTIONS FOR INLAND NAVIGATION VESSELS:
On appropriate projects, install earthing of systems for onshore units of electrical shore connections for inland navigation vessels to BS 7671 (IET Wiring Regulations), Section 730. Ensure all conductors subject to movement on floating landing stages are arranged and of materials to avoid the deleterious effects of movement on the landing stage. Do not extend a PME or TN-C-S system earthing terminal to a vessel supply socket outlet. Do not use any aluminium or mineral insulated metallic clad cables as protective conductors. Use no joints in protective conductors except at properly protected enclosures. Bond all metalwork on pontoons or landings which may come into contact with the electrical system to the system protective conductor. Provide fuelling point bonding conductors and connection to the system protective conductor so that vessels may be bonded before a fuel connection is broken.
Where a fixed onshore isolating transformer is used to prevent galvanic currents circulating between the hull of the vessel and conductive parts on the shore, ensure the protective conductor of the circuit supplying the transformer is not connected to the protective conductor of the secondary.

320.160 EARTHING OF ELECTRICALLY SUPPLIED STREET FURNITURE:
Install earthing to street furniture in accordance with BS 7671 (IET Wiring Regulations) and BS 7473.
TN-S systems

Use cable with separate phase neutral and protective conductors to supply street furniture.

Ensure on the load side of the protective device separate phase, neutral and protective conductors are used.

Bond conductive parts of the street furniture to the earthing terminal within the equipment. Connect the street furniture incoming supply protective conductor to the same earthing terminal.

TN-C-S / PME systems

Comply with the latest version of Energy Networks Association (ENA) Engineering Recommendation G12 "Requirements for the Application of Protective Multiple Earthing to Low Voltage Networks".

Use cables with separate neutral and earth for private installations, and where specified for local authority installations.

Ensure use of combined neutral and earth cables is limited to street lighting and road signs rated 500 W or less, supplied by a distribution network operator or where specified for a street lighting authority.

Do not bond small items not likely to come into contact with exposed or extraneous conductive parts or earth.

On circuits feeding more than one item of street furniture, provide an earth electrode of 20ohm or less resistance at the last or penultimate item of furniture on the circuit.

Where an electrode resistance of 20 ohm cannot be achieved, provide earth electrodes at each item of furniture.

Where the supplier's earth terminal is not used or TT systems

Install a protective earth electrode system at the source of supply in accordance with BS 7430 and BS 7671 (IET Wiring Regulations).
Use cable with separate phase neutral and protective conductors to supply the street furniture, with the protective conductor connected to the earth electrode. Ensure on the load side of the protective device separate phase, neutral and protective are used.
Bond conductive parts of the street furniture to the earthing terminal within the equipment. Connect the street furniture incoming supply protective conductor to the same earthing terminal.

320.170 EARTHING OF ELECTRICAL SYSTEMS IN HAZARDOUS AREAS:
Install earthing of electrical systems in hazardous areas to BS 7671 (IET Wiring Regulations), BS 7430 and relevant parts of BS EN IEC 60079 / BS EN 60079.

Use the recommendations in APEA Design, Construction and Modification, Maintenance and Decommissioning of Filling Stations (4th edition), at petrol filling stations.
Use the recommendations in APEA Design, Construction and Modification, Maintenance and Decommissioning of Filling Stations (4th edition,) in hazardous areas.

320.180 OVERHEAD LINE EARTHING:
Earth overhead line plant in accordance with BS 7430 and the Electrical Safety, Quality and Continuity Regulations 2002. Do not earth or bond insulator steelwork unless so directed.

320.190 EARTHING OF PHOTOVOLTAIC (PV) SYSTEMS:
Earth PV electrical systems to BS 7671, Section 712.

320.200 EARTHING OF MEDICAL LOCATION SYSTEMS:
Earth medical location electrical systems to BS 7671, Section 710 and HTM 06-01.
Ensure supplementary bonding systems for medical locations:

Maintain a voltage between simultaneously accessible exposed-conductive-parts (including earth contacts of socket-outlets and equipotential bonding connection points) and/or extraneous-conductive-parts under all conditions, including faults, of less than: AC 25 V or DC 60 V.
Have a maximum resistance between simultaneously accessible exposed-conductive-parts (including earth contacts of socket-outlets and equipotential bonding points) and/or extraneous-conductive-parts that does not exceed 0.2 Ω

10000 Based on NES VERSION W51 TEXT May 19 and Y80 TEXT Dec 18.

W52 – Lightning and Surge Protection

Incorporates Y80

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide systems for the protection of buildings, structures, towers, exposed metal work and any projection above the general roof level from lightning.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W52

300.000 GENERAL

300.010 STANDARDS:
Provide risk assessments in accordance with relevant part of BS EN 62305, state the results for Human Life, Services to the Public, Cultural Heritage and Economic Values where applicable.
Provide an external lightning protection system (LPS) in accordance with the risk assessment results and BS EN 62305 and BS 7671 (IET Wiring Regulations).
Provide an internal lighting and surge protection system (LSPS) in accordance with the risk assessment results and BS EN 62305 and BS 7671 (IET Wiring Regulations).
Provide lightning protection connection components complying with BS EN 62561-1, BS EN 62561-2 and BS EN 62561-3. Surge protection to achieve an Installation Overvoltage Category of CAT II or CAT I as appropriate to the connected equipment, in accordance with BS 7671 (IET Wiring Regulations) and BS EN 62305-3.
Provide lightning protection earthing enhancing components complying with BS EN 62561-7.
Provide lightning protection system for churches in accordance with the recommendations of the English Heritage and Ecclesiastical Insurance Group, Lightning Protection for Churches.
In health care premises comply with HTM and HBN requirements, and CIBSE Guide K.
Provide earth soil electrical resistivity test results using a recommended method in BS 7430.
Surge protection to achieve an Installation Overvoltage Category of CAT II or CAT I as appropriate to the connected equipment, in accordance with BS 7671 (IET Wiring Regulations) and BS EN 62305-3.

300.020 USE OF BUILDING ELEMENTS:
Ensure that building and structural elements used as items in or bonded to the lightning protection system are designed and erected in accordance with BS EN 62305 as well as their appropriate constructional specification or code of practice. Ensure that all connections to building and structural elements are waterproof and corrosion protected to a degree appropriate to their exposure. Use BS EN 62305-3 Annex E as a code of practice for the design and construction of the LPS.
Where building structural and/or foundation steelwork are to be used as lightning current conduction paths, the electrical continuity, EMC separation distance and cross-section area of the element shall meet the requirements of BS EN 62305.

300.030 LIGHTNING AND SURGE PROTECTION SPECIALIST:
Engage a specialist to carry out the design, installation, testing and commissioning of the lightning and surge protection system (LSPS). Refer to scope of work for detail requirements.

300.040 APPROVALS:
Where applicable obtain the approval of all authorities concerned for the installation of the lightning and surge protection system. Comply with the regulations of all concerned authorities for the installation and connection of public utility services to a common earth termination network, comply with agreements made with bodies concerned with adequate separation distance from other services connected to a common earth termination network.

300.050 REGULATIONS AND AGREEMENTS
Comply with the regulations of all concerned authorities for the installation and connection of public utility services to a common earth termination network, comply with agreements made with bodies concerned with adequate separation distance from other services connected to a common earth termination network.
For telecommunication services comply with relevant part of BS EN 50174

300.060 EARTHED EQUIPOTENTIAL BONDING OF SERVICES:
Provide Earthed Equipotential bond for relevant metallic services in or on the structures in accordance with BS 7671 and BS EN 62305-1, BS EN 62305-3 and as indicated in the Schedules and Drawings.

300.070 PROTECTION OF ELECTRONIC EQUIPMENT:
Protect electronic equipment against lightning induced EMC and over-voltage surges in accordance with BS 7671 and relevant parts of BS EN 62305.

300.110 EXISTING INSTALLATIONS:
Check soil resistivity and earth electrode resistance of existing installation. Report defects and elements not in accordance with BS EN 62305 before connecting new or modified installations.

310.000 PRODUCTS/MATERIALS

310.001 MATERIALS GENERALLY:
Use materials and installation methods in accordance with BS EN 62305, BS 7671, and BS 7430.

Conductors shall be annealed copper strip (unless specified otherwise) or hard drawn copper rod, unless specified otherwise.

310.005 AIR TERMINATIONS: (Y80.2010A)
Standard BS EN IEC 62561-2 (other than natural conductors)
Horizontal or self-supporting air terminations, material, type (strip or rod) and covering as indicated on drawings.
Where appropriate use building elements (natural conductors) as part of the air termination in accordance with BS EN 62305-1, BS EN 62305-3, and BS EN 62305-4.

310.006 DOWN CONDUCTORS:
Standard BS EN IEC 62561-2 (other than natural conductors)
Materials as indicated on drawings.
Where appropriate use building elements (natural conductors) as down conductors, main terminations in accordance with BS EN 62305-1, BS EN 62305-3, with non-ferrous bonding points built as Figure E.7 for reinforcing bars.
Ensure reinforcing bars are in good electrical contact by welding, unless otherwise indicated on the drawings.

310.007 TAPE FIXING DEVICES: (Y80.2030A)
Standard BS EN 62561-4 for lighting protection system conductor fasteners.
Secure lightning protection tape to structure with corrosion resistant proprietary fixing devices which avoid piercing tape and ensure 3mm (minimum) clearance of tape from structure.
Space fixing 450 mm max on vertical conductors, 1,000 mm horizontally.
Material for lightning protection systems - non-conducting.
Material for system earthing - bronze

310.008 CONDUCTOR JOINTS: (Y80.2020, 3030, 3040)
Standard BS EN 62561-1
Provide waterproof protection at joints subject to moisture.
Joint copper tapes by
tinning before assembly and riveting with two minimum copper rivets. Overlap straight joints by length equivalent to twice (minimum) tape width. Overlap both sides of main tape at tee joints or naval brass bolts or copper rivets (two minimum) and sweat solid whole joint or
Brazing, using zinc-free brazing metal with melting point at least 600ºC or
Thermic welding or Cold pressure welding.
Dimensions - To BS EN IEC 62561-2 minimum for lightning protection system
Joint aluminium tapes by
Welding to BS EN 1011-4.
Joint circular rods as tapes using through coupler.
Joint stranded conductors with compression joints to BS EN 61238.
For bolted connections use crimp type lugs compressed by automatic tool to achieve correct pressure and crimp depth.
Use phosphor bronze bolts, nuts and washers to make connections between conductors and equipment.

310.011 TEST JOINTS: (Y80.2020)
Standards - BS 7671, BS EN 62561-1, relevant parts of BS EN 62305
Provide test joint at each down conductor readily accessible from ground level.

Use proprietary components of cast gun-metal with phosphor-bronze bolts, nuts and washers.

310.012 EARTH ELECTRODES: (Y80 2040)

Standards - BS 7430, relevant parts of BS EN 62305, BS EN IEC 62561-2 and BS 7671 (IET Wiring Regulations) as appropriate to the particular specification. Form - Roll threaded rod.

Earth electrodes in draw pits

Provide concrete cover, permanently labeled, for electrodes installed through cable drawpit bases.

Material, minimum size as BS EN 62561-2

Molecularly bonded copper clad steel rods to BS EN IEC 62561-2.

Accessories

Rod to tape clamp or U-bolt clamp. Accessories sized to suit earth rod and connector.

Rods

Use high tensile strength steel cored molecularly bonded copper sheathed rods to BS EN 62561-2 with threads rolled on to rods. Sheath thickness 0.25mm (minimum).

Rod Diameter 15 mm - nominal.

Earth electrode couplings

Use silicon bronze alloy, counter bored to completely enclose rod threads. Ensure rods meet in centres of coupling.

Use high strength driving cap in contact with driven rod and couplings of compatible material fully enclosing the rod threads.

Earth electrode tape

Interconnect electrodes using 25x3mm bare copper tape or stranded copper cables.

Location

Locate electrodes not more than 2m distant from building/structure protected, and away from telecommunication and pilot cables and metallic fences.

Locate electrodes as indicated on drawings.

Driving

Drive rods vertically into ground with purpose designed electric hammer. (Where impenetrable strata encountered at shallow depth, drive at 30° to horizontal).

Depth of rod 2.4m (2 x 1.2) minimum below finished ground surface.

Depth of Electrode heads

Locate electrode heads just below ground level.

Spacing

Where electrodes are installed in a group ensure minimum distance between electrodes is twice depth of rods. Where rods for 'clean' earth are installed ensure distance from any other system rods is six times depth of 'clean' rods.

Tape Depth

Install interconnecting tape 750mm below finished ground level, rising vertically at each electrode unless ground conditions dictate otherwise.

General

Ensure that materials and dimensions of earth electrodes have adequate mechanical strength and are selected to withstand corrosion such that the mechanical integrity of the structural element is not impaired, and the possible increase in earth electrode resistance is minimised.

Where an earth electrode consists of parts that must be connected together, ensure connections are made by welding, pressure connectors, clamps or other suitable mechanical connectors.

Ensure earth electrodes intended to minimise touch voltage, to exposed-conductive-parts and extraneous-conductive-parts, in the event of a broken protective earth and neutral (PEN) conductor in the public supply network, are designed with consideration of, as a minimum, the likely loads in the installation, the relevant network conditions, and the design guidance in IET Guidance Note 5: Protection Against Electric Shock.

310.013 EARTH ELECTRODE CLAMPS: (Y80 2060)

Connect tape to electrode head using heavy duty purpose made silicon aluminium bronze body connector clamps or leaded gunmetal body connector clamps, and high tensile phosphor bronze bolts to BS EN 12163.

310.014 EARTH ELECTRODE INSPECTION FACILITIES: (Y80 2070, 2080)

Standard BS EN 62561-5

Provide enclosure for each connection between down conductor and earth electrode. Install so that top of removable inspection cover is flush with finished ground level. For internal locations where the electrode passes through water retaining structure provide puddle flange and sealing gland to BS EN 62561-5 suitable for anticipated water

pressure, to prevent moisture penetration and duct from enclosure to adjacent wall for conductor. Ensure enclosure provides adequate access for testing purposes. Inscribe cover with legend `Lightning Protection Earth'

Provide pit details for builder's work.

After installation of electrode drain all water from pit.

Use concrete, galvanised steel embedded in concrete or polycarbonate as indicated on drawings. Cover to suitable for anticipated loading and to accept finish, where applicable.

310.015 SOIL CONDITIONING AGENT (Y80 2040)

Provide soil conditioning agent only where design indicates necessary.

Conditioning agent to be suitable for application.

310.021 BUILDING ELEMENTS:

Use building elements as natural conductors in accordance with BS 7671 and BS EN 62305-3 using Annex E as a code of practice for design, construction and test.

Ensure reinforcing bars are in good electrical contact by welding, unless otherwise indicated on the drawings.

310.031 LIGHTNING PROTECTION SYSTEM BONDS:

Standard BS EN 62561-1

Provide bonds between lightning protection conductors and building elements, exposed structural steelwork, and external plant using corrosion resistant proprietary components and fixings.

310.041 DECORATIVE FINIALS:

Provide proprietary solid copper air terminals with cast gun-metal terminal base or purpose made finial as drawings.

310.051 SURGE PROTECTION DEVICES:

Standard BS EN 62305.

Enclosure protection BS EN 60529, IP31 for internal applications and IP54 externally.

Protect equipment against the risk of permanent failures or damage due to surges by considering the withstand voltage Uw as defined by BS EN 60664-1 (see BS 7671 Table 443.2)

Standard - PD IEC/PAS 60099-7, DD CLC/TS 50539-22 and BS EN 61643-11.

Selection method DD C LC/TS 50539-22, DD CLC/TS 61643-12.

Select SPD type and association protective devices in accordance with BS 7671 (IET Wiring Regulations)

Refer to scope of works for – System earthing type, location category, system exposure, transient performance, passive state performance and other details.

Classification of SPD to DD CLC/TS 50539-22, BS EN 61643-11

320.000 WORKMANSHIP

320.010 INSTALLATION:

Install the lightning and where applicable the surge protection system and its element in accordance with the manufacturers recommendations and BS EN 62305, BS 7671 (IET Wiring Regulations) and the earthing and bonding elements to BS 7671 and BS 7430.

In churches install in accordance with recommendations in the English Heritage and Ecclesiastical Insurance Group, Lightning Protection for Churches.

For healthcare premises also comply with the recommendations given in the HTM and HBN documents, and CIBSE Guide K.

320.016 DISSIMILAR METALS: (Y80.3020)

Ensure, where dissimilar metals are used for system, that purpose made jointing materials are used such that corrosion and deterioration of the electrical connection are not caused. Ensure bonding connections to other metal parts of building are electrolytically compatible with those metal parts. Use the guidance given in BS 7430 Table 9 and BS EN 62368-1 Annex N when bonding dissimilar materials.

320.020 WORK ON SITE:

Ensure that all building works are completed and service connections are provided.

320.030 QUALITY CONTROL:

Handle, store and install all equipment and components of the lightning protection system in accordance with the manufacturers' recommendations and BS EN 62305, BS 7430, BS 7671 and appropriate parts of BS EN 62561.

Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.
Test and commission the system in accordance with BS EN 62305 BS 7430, BS 7671 and as specified. Record all test measurements.

320.040 EARTHED EQUIPOTENTIAL BONDING:
Bond or isolate building structural elements and metallic services as BS EN 62305, BS 7430 and BS 7671.
Refer to scope of works and drawings for further details.

320.050 LABELLING:
Provide and fix system labels as required by BS EN 62305, BS 7671, BS 7430 and relevant parts of BS EN 50174 (IT cabling installation).

320.055 SURGE PROTECTION DEVICES:
Install surge protection devices in accordance with BS 7671, BS EN 50174, DD CLC/TS 50539-22 and BS EN 61643-11 and the manufacturer's recommendations.

320.056 RESIDUAL CURRENT DEVICES:
Install residual current devices suitably coordinated with surge protection devices in accordance with BS 7671, BS EN 50174, DD CLC/TS 50539-22 and BS EN 616143-11 and the manufacturer's recommendations to avoid nuisance tripping.

320.060 INSTALLATION RECORDS:
Prepare system records to BS EN 62305, BS EN 50174 and BS 7430 including the following items:

As installed drawings detailing:-
Nature of soil
Earth resistivity measurement.
Earth electrode resistance.
Details of earth electrodes and lightning earth termination network

320.070 MAINTENANCE:
The Lightning and surge protection system (LSPS) shall be designed and installed with ease of carrying out maintenance - test points and access to lightning and earthing elements should be provided.
Carry out maintenance as required by BS EN 62305 for the defects liability period and provide proposal for continuing maintenance

10000 NES VERSION W52 and Y80 TEXT Dec 18.

W53 – Electromagnetic Compatibility

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES / DESIGN PARAMETERS

To provide systems for the protection of buildings, structure, plant, equipment and personnel from the interference from electro-magnetic fields and electro-static forces.

Provide an earth bonding system within the premises which, as low as reasonably practicable, eliminates the risk of electrical shock (including micro-shock) from the electrical system under all conditions.
For electromagnetic compatibility, earthing and bonding requirements within healthcare premises, consider the appropriate standards, examples of which are listed in Tables 7 and 8 of Section 11 of HTM 06-01.
Physically separate power distribution and data/communications services where appropriate (Refer to relevant parts of BS EN 50174).

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W53

300.000 GENERAL

300.005 ELECTROMAGNETIC SITE SURVEY

Carry out an electromagnetic site survey in accordance with separate specification or described in the scope of works and report findings to Contract Administrator.

Engage a specialist to carry out the electromagnetic site survey.

300.011 STANDARDS AND REGULATIONS:

Provide risk assessments on EMC to meet the requirements of the Electromagnetic Compatibility (EMC) Regulations, provide a risk matrix stating the impacting results for EMC source(s) and victim(s) where applicable.
Provide an EMC compliance file for equipment which is required to demonstrate EMC conformance to EMC Regulations. HTM and HBN (on healthcare projects), supplemented by BS EN 61000 series, ENA G5/4, BS EN 50174-1, BS EN 50174-2 or BS EN 50174-3, BS EN 50310, BS 7671 and BS EN 62305 where applicable.
Provide bespoke EMC test results from UKAS accredited testing facility on equipment which does not have EU/UK EMC conformance test certification.
Provide earthing meeting the requirements of HTM and HBN, BS 7671, BS 7430, and BS EN 50522
Where described in the scope of works, engage an EMC specialist to provide a peer review of the EMC risk assessment's results.
Where described in the scope of works, engage an EMC specialist to provide a peer review of the EMC earthing and control design strategy and implementation plan.

300.020 ELECTROMAGNETIC EXPOSURES LEVEL:

Considerations shall be given to the safe reference exposure levels stated by International Commission on Non-Ionizing Radiation Protection (ICNIRP) and identified by EMC risk assessments and equipment vendors.
Provide suitable installation method for selecting equipment to ensure safe reduced exposure levels can be achieved.

300.030 SOURCES OF EM DISTURBANCES:

Considerations shall be given to the location of the following potential sources and victims of electromagnetic (EM) disturbances relative to the positioning of other equipment:

- Switching devices for inductive and capacitive loads.
- Electric motors.
- Discharge type of lighting fittings.
- Welding machines or machines of a similar current intake characteristics.
- Rectifiers.
- Choppers.
- Dynamic or static frequency convertors/regulators including variable speed drives.
- Lifts and escalators.
- Conveyors or machines of a similar current intake characteristics.
- Transformers.
- Generators and alternators.
- UPS.
- Small scale distributed generators (PV, wind turbines, water turbines, CHP, etc.).
- HV and LV switchgears.

HV and LV power distribution cables and busbars.
HVAC plants.
Functional safety control (including life-safety and life-support) equipment.
Pumps (water, fire, etc.).
Sprinklers control.
Fire alarms and Very Early Smoke Detection Apparatus (VESDA) sensor and cabling.
Smart meters.
Smart grip appliances.
Data distribution cables and buses.
Data servers and computer clusters.
WiFi-routers and switching hubs.
Powerline networking equipment.
LED based equipment.
CCTV.
Public address equipment.
Security access equipment.
Telephony (VOIP, mobile and land-line).

300.040 REDUCING EMI:

Where described in the scope of works provide an earthed equipotential MESH-BN (Bonded Network) and an earthing system that can effectively reduce EMI influences and is appropriate for the EMI sources and associated EMI victims.

Provide suitable measures to reduce the harmful effects of EMI influences considering:

Avoidance of neutral conductor currents in a bonded structure.
To limit protective conductor currents from flowing through the screens and cores of signal data and/or control cables.
To limit fault currents from flowing through the screens and cores of signal data and/or control cables.
Separation of power, control, signal and data cables.
Minimise cable loop areas for the flow of normal and fault currents.
Use of surge protection devices.
Use of EMI filters.
Use of EMI screening walls and floors.
Use of metal-free non-conductive data and control signal carrying medium.

300.050 EMI COUPLING PATHS:

Provide reduced EMI coupling paths between EMI source(s) and victim(s) in accordance with industry recognised best practice.

300.060 APPROVALS:

Where required, obtain the approval of all authorities concerned for the installation for EMC. Comply with the regulations of all concerned authorities for the installation and connection of public utility services to a common earth termination network, comply with agreements made with bodies concerned with adequate separation distance from the other services connected to a common earth termination network. Refer to scope of works for details.

300.070 REGULATIONS AND AGREEMENTS:

Comply with regulations of all concerned authorities for the installation and connection of public utility services to a common earth termination network, comply with agreements made with bodies concerned with adequate separation distance from other services connected to a common earth termination network. Refer to scope of works for details.

300.080 EARTHED EQUIPOTENTIAL BONDING OF SERVICES:

Earthed equipotential meshed bonding relevant metallic services in or on the structures in accordance with BS EN 50174, BS EN 50310 and as indicated in the scope of work, schedules and drawings.

300.090 ELECTROMAGNETIC SITE SURVEY:

If required carry out electromagnetic site survey as detailed in the scope of works and report findings to CA.

320.000 WORKMANSHIP

320.010 INSTALLATION OF LV AND FUNCTIONAL EARTHING SYSTEM:
Install EMI source and victim equipment and their associated conductive and radiative mediums in accordance with industry recognised best practice to meet the requirements of the EMC Regulations 2016.

320.030 QUALITY CONTROL:
Handle, store and install all EMI source and victim equipment and components in accordance with manufacturer's recommendations and

- BS EN 50310
- BS EN 50174
- BS EN 62305
- BS 7430
- BS 7671
- CIBSE Guide K

Inspect all equipment and components on delivery, before fixing and after installation, then reject and replace any which are defective.
Test and commission the system in accordance with BS EN 50310, BS EN 50174, BS EN 62305, BS 7671, BS 7430 and as specified elsewhere.
Record all test measurements.

320.050 LABELLING:
Provide and fix system labels as required by
BS EN 62305, BS 7671 and BS 7430

320.055 HARMONICS AND RFI/EMI FILTERS:
Where required, install harmonics and RFI/EMI and filter devices in accordance with ENA G5/4, BS 7671, BS EN 50174 and BS EN 50310 and the manufacturer's recommendations.

320.060 INSTALLATION RECORDS:
Prepare system records to BS 7671 and to CIBSE Guide K

10000 NES Based on VERSION W53 TEXT May 19

W60 - Central Controls / Building Management System

PART 1 SYSTEM OBJECTIVES
This work section is derived from the BSRIA Standard Specification for BMS – Application Guide AG 9/2001. It must be read in conjunction with all the appropriate work sections, schedules, **controls drawings** and Y reference specifications. Particular attention should be made to A 37 for Operation and Maintenance Manuals / training requirements and to Y51 for Commissioning and handover requirements.
Refer to Y60 for conduit and cable trunking
Refer to Y61 for cables and wiring
Refer to Y63 for support components – cables
Refer to Y71 for switchgear and distribution boards
Refer to Y72 for contactors starters and drives
Refer to Y92 for motors
Refer to W51 for LV earthing and bonding

Controls drawings
The Controls tender drawings show schematic details of all main plant items and associated control components. They indicate the conceptual arrangement of the plant with each item identified together with a description of the controls operation and details of the associated interlocking. Where terminal units are included on the controls diagrams they show the "typical" control requirements for each unit. The Controls Specialist shall establish actual quantities of terminal units and associated control components from the detail design drawings and/or equipment schedules before production of Controls Logic diagrams as defined in work section A31 or A64 or A64D of this specification.

100.011 PERFORMANCE OBJECTIVES:
To provide a control system for the operation of services and equipment, the collection of information on operational settings and status, and where appropriate, process data for the management and operation of the building.

To provide all power wiring and containment to mechanical plant from main distribution boards or MCC's, all power wiring and containment to lighting in packaged mechanical plant such as air handling units, all control wiring / containment (including local controls serving plant not controlled by the BMS – eg local extract fans) and all interlocks between plant and safety systems including automatic shut off valves in gas supplies.

To install final power supply wiring / containment between local mechanical plant and fused spurs provided by the electrical contractor (including fan coil units, local fans, window mounted fans, local heaters etc)

To make all digital and analogue control interfaces between the BMS and packaged plant, energy / utility services meters and motor inverter drives as detailed on the Controls diagrams and individual plant schedules and elsewhere in the specification. Any apparent discrepancy between the specification / plant schedules and drawings shall be drawn to the attention of the Contract Administrator before or with the tender submission. Otherwise the Contractor shall be deemed to have made the maximum allowance within their tender.

For all buildings with a total usable floor area greater than 1000m^2 and as described in the scope of works, provide all necessary software and hardware for automatic readings of all energy and utility supply meters. The software shall be capable of real time analysis of the data. The consumption data shall presented as profiles and reports to enable consumption data to be audited against targets and consumption profiles.

To hard wire interlocked chilled water primary pumps with chiller controls to prevent operation of the chiller if the pumps are not operating.

100.020 DESIGN PARAMETERS:
Controls/BMS supplier/installer shall provide a schedule of site conditions including security, cleanliness, weather protection etc. that must be maintained before equipment is delivered.

100.023 OPERATING CONDITIONS:

Unless otherwise indicated equipment shall be suitable for operating within the following environmental ranges:-

Operator facilities	-	located in general office areas	
		Temperature -	10°C to 35°C
		Humidity -	20% RH to 80% RH
Operator facilities		located in plant areas, and Outstations	
		Temperature -	0°C to 50°C
		Humidity -	10% RH to 90% RH
Electrical environment		:as associated with building services plant room areas.	
		:protected against effects of conducted and radiated interference to IEC 801 Part 3 (1984) and Part 4 (1988)	
Dust and dirt		:as associated with the indicated location of the equipment.	

The overall installation shall be capable of maintaining conditions within the following accuracies:

Temperature	+/- 0.5 °C
Humidity	+/- 5% RH

100.024 POWER SUPPLIES:

The supply to the distribution boards/MCC's shall be 400 Volts, 3 phase, 50 Hertz, 4 wire, TN-S.
Unless otherwise indicated ensure all control equipment operates normally from a power supply of:

Voltage	-	230V +10%/-6%
Frequency	-	50Hz +/- 1%

100.025 EXPANSION

Arrange system to allow 25% expansion without redundancy.(ie: by addition rather than replacement of hardware), without compromising the BMS system's functionality or speed of operation.

100.026 COMMISSIONING

Commissioning requirements for the automatic controls systems / BMS are given in clause 350.000 and work section Y51. (also refer to A33 or A64 or A64D).

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W60

300.000 GENERAL

300.010 SYSTEM REQUIREMENTS:

Select control components and equipment, suitable to meet system objective requirements. Ensure that system safety complies with:

- BS EN 61508-series for control of systems where an assessed safety integrity level is required.
- BS EN ISO 13849-1 and BS EN ISO 13849-2 for safety-related components of control systems.
- BS EN 13850 for design of emergency stop functions.
- BS EN 61511-1 for functional safety of programmable controllers.

Comply with BS EN 15500-1 for electronic individual zone control equipment.

Comply with relevant parts of BS EN 60730 for automatic electric controls.

Comply with the following standards for building automation and control systems (BACS) components:

- BS EN ISO 16484-2 for hardware
- BS EN ISO 16484-3 for functions

Comply with the requirements of the relevant parts of BS EN 50491, and BS EN 63044/BS EN IEC 63044 appropriate to the project, for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS).

Install all switches, controls, outlets and meters and all other items that require access in accordance with the relevant part of BS 8300: Design of an accessible and inclusive built environment.

Ensure that the system is designed and implemented to comply with BS EN 16947-1 and PD CEN/TR 16947-2 for overall alarming, fault detection and diagnostics, reporting, monitoring, energy management functions, functional interlocks and optimizations to set and maintain energy performance of buildings.

300.020 CONTROL SYSTEM:

Provide a Building Management System (BMS) to meet the particular requirements detailed in the scope of works and / or control strategy diagrams and schedules. Scope to include, equipment design,
development of design, supply, installation, commissioning, setting to work, operator training, fine tuning and seasonal commissioning during the defects period.

Supply and install control equipment to provide a means of controlling and indicating the performance of other systems within set criteria and varying their criteria as required from a central location.

300.030 CONTROLS SPECIALIST:

Use a controls specialist to design, supply, install, test and commission complete controls / BMS installation.

300.051 COMPRESSED AIR:

Where required the compressed air plant is specified in work section S30. Ensure the compressed air is available to pressure, quantity and cleanliness requirements to suit the control devices.

300.060 CONTROL COMPONENTS MANUFACTURER:

Unless otherwise indicated use control components and equipment from one manufacturer throughout.

300.091 FINISHES:

Ensure all equipment is designed to common installation practices. Provide all equipment as a matching suite.

300.100 ELECTROMAGNETIC COMPATIBILITY:

Ensure all monitoring system equipment is compatible, and does not adversely affect any other equipment installed in the same location.

Ensure all systems are designed and installed with due consideration to good electromagnetic compatibility (EMC) practice, and in line with EMC requirements of relevant standards including:

- BS 7671 (IET Wiring Regulations)
- BS EN 50310 for earthing and bonding in relation to communications system components
- BS EN 50174-series for communications and control cabling
- BS EN 61000-6-7 and BS EN 61000-1-2 as relevant for EMC in relation to functional safety

Ensure all equipment complies with BS EN 50130-4 where relevant.

Ensure fire alarm interface equipment complies with BS EN 50130-4 where relevant.

300.130 INTEGRATED SYSTEM:

Provide integrated system combining the sub-systems as scheduled or described in the scope of works into the BMS.

Ensure interfaces comply as necessary with relevant parts of BS 5839 and BS 7273.

300.132 BREEAM / WELL REQUIREMENTS:

On applicable projects and as detailed elsewhere, comply with BREEAM requirements below to suit the type of construction and scheme.

Provide the following unless detailed otherwise elsewhere.

A plasma screen for wall mounting installation in the building reception.

Software within BMS, to give as a minimum, a real-time display of

How much energy is being generated from all renewable energy systems and how much non-renewable energy is being consumed. Information to be gathered from all pulsed output energy usage over the same period.

Energy usage/generation of past year or month.

If a rainwater collection or grey water collection system is installed, how much water has been collected over a previous time period and what contribution this makes to the building overall usage over the same period.

BREEAM New Construction 2018 requirements

Comply with Issue ID Man 04 Commissioning and handover
Comply with Issue ID Man 05 Aftercare
Comply with Issue ID Ene 02 Energy monitoring
Comply with Issue ID Wat 02 Water monitoring
Comply with Issue ID Wat 03 Water leak detection
Comply with Issue ID Pol 01 Impact of refrigerants

BREEAM Refurbishment and Fit-out 2014 requirements

Comply with Issue ID Man 04 Commissioning and handover
Comply with Issue ID Man 05 Aftercare
Comply with Issue ID Ene 02 Energy monitoring
Comply with Issue ID Wat 02 Water monitoring
Comply with Issue ID Wat 03 Water leak detection
Comply with Issue ID Pol 01 Impact of refrigerants

Where the building is being assessed to the WELL Building Standard v1 comply with feature

Comply with feature 18 Air Quality Monitoring and Feedback
Comply with feature 23 Advanced Air Purification

310.020 GENERAL REQUIREMENTS - ELECTRICAL SAFETY:

Ensure that the BMS complies with the following legislation:

The Electrical Equipment (Safety) Regulations 2016
The Construction Products Regulations 2013
The General Product Safety Regulation 2005

Ensure that the BMS installation complies with BS 7671.

Ensure that control panels comply with:

Relevant parts of BS EN 61439-series.

BS EN 60204-1 where the control panel is classed as Machinery in accordance with the Supply of Machinery (Safety) Regulations 2008 as amended.

310.020 GENERAL REQUIREMENTS - ELECTRICAL SAFETY:

Ensure that the BMS complies with the following EC Directives

Low Voltage Directive 73/23/EEC and amendments 93/68/EEC.
Construction Products Directive 89/106/EEC.
General Product Safety Directive 92/59/EEC.

Ensure that the BMS installation complies with BS 7671 Electrical installations in buildings.

Ensure that control panels comply with BS EN 61439-1 Low-voltage switchgear and control assemblies.

310.030 GENERAL REQUIREMENTS - ELECTRICAL SUPPLY:

Ensure that the BMS can be supplied with electricity conforming to:
The Electricity Safety, Quality and Continuity Regulations 2002 (as amended); and
BS EN 50160 Voltage characteristics of electricity supplied by public distribution systems; and
Additional voltage drop within the consumer's electrical installation according to BS 7671 (IET Wiring Regulations).

310.051 GENERAL REQUIREMENTS - EMERGENCY RESTORATION PROCEDURES

Ensure that the BMS fully restores all control and monitoring functions following an emergency shut down period.
Ensure that the start delay times can be adjusted according to the magnitude of the load.
Ensure that the system restart does not cause unsafe operating states.

310.061 GENERAL REQUIREMENTS - UNINTERRUPTIBLE POWER SUPPLY FACILITY:

Uninterruptible power supply facility requirements - As work section V32 or detailed in scope of works.

310.070 GENERAL REQUIREMENTS - TIME SYNCHRONISATION:

Ensure that all time-dependent BMS components are time synchronized.
Ensure that the BMS can automatically handle daylight saving adjustments including changes between British Summer Time (BST) and Greenwich Mean Time (GMT)
Ensure that the BMS can accommodate time adjustments such as leap years and leap seconds.
Refer to scope of works for any project specific detailed requirements.

310.080 GENERAL REQUIREMENTS - SYSTEM SECURITY:

Standard - IET Code of Practice for Cyber Security in the Built Environment.
Provide, as a minimum, operator access for the following levels based on user's login credentials

Level 1 - Ability to display all point data.
Level 2 - Ability to display all point data and to initiate data logging functions.
Level 3 - Ability to display all point data; to initiate data logging functions; and to change set points and time schedules.
Level 4 - Ability to display all point data; to initiate data logging functions; to change set points and time schedules; and to change control strategies and schematic/graphics functions and password assignment.

Ensure that appropriate credential-based operator and maintenance technician access is set up for clients, servers and field controllers.
Login access type to be via password unless detailed otherwise in the scope of works
Manage information security of systems, software and data during design, implementation and commissioning in line with BS EN ISO/IEC 27001.
Ensure that the BMS software is protected from unauthorised entry.
Ensure that the BMS can be maintained by a service provider with BS EN ISO/IEC 27001 and BS ISO/IEC 20000-1.

310.091 GENERAL REQUIREMENTS - SYSTEM SOFTWARE:

SOFTWARE DEVELOPMENT:

Prior to commencing the development of project specific software confirm the following information

: operating system, revision and issue number
: other packaged software to be provided, revision and issue number
: availability and cost of any further appropriate packaged software not specifically specified.
: functional description of any software needed to be written for "The Works", procedure for its preparation and development period. Provide summary of previous experience of writing similar software.
: details of software support service available to client, where future software would be written and how charged.

Demonstrate the operation of all software for conformity with the specification prior to installation.
Procedures for modifying the configuration, graphics pages and parameters shall allow alterations and additions to be made systematically without the need to shut down the BMS or any Engineering Systems.
All software shall support, without modification, the future addition or removal of outstations or points up to the practical limit of the installed software.

Obtain on behalf of the end users all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Provide documentation for application software in accordance with BS ISO/IEC 26513 and BS ISO/IEC 26514.
Ensure that, as far as practicable, all software is commercially available off-the-shelf.
Ensure that any programmable configuration, customisation, and bespoke software, is developed, tested and commissioned using relevant processes and procedures complying with BS ISO/IEC/IEEE 12207 or BS ISO/IEC/IEEE 15288, supported by a quality management system meeting the requirements of BS EN ISO 9001.Ensure that IT industry standard operating systems are used.
Ensure that copies of all BMS vendor-specific software are held by an independent third party and that this software can be released to the client.
Ensure that the ESCROW Agreement is completed and signed.
Use communications protocol to relevant parts of BE EN 14908.

310.093 GENERAL REQUIREMENTS - CHOICE OF CONTROL STRATEGY:
Where detailed control strategies are not provided or where design development of the control strategies provided in the tender documents is required, ensure that the selected control strategies are appropriate for the building services systems and their intended application.
Ensure that selected control strategies are robust and not over complex.
Where a novel control strategy is to be implemented, ensure that testing/evaluation is performed to confirm its suitability.
Ensure that on project where a detailed control strategy is not provided, wherever possible selected control strategies are based on those provided in the BSRIA Library of System Control Strategies: AG 7/98.

310.095 GENERAL REQUIREMENTS - DESIGN FOR COMMISSIONABILITY:
Ensure that the BMS specification details required for commissioning are made available to the BMS commissioning engineer.
Ensure that all field controllers, sensors and controlled devices are easily accessible and can be removed for testing and future maintenance.
liaise with the mechanical contractor to ensure that air handling units are provided with appropriate access doors.
Ensure that access is available to all control devices. Comply as appropriate with:
- BS EN 547-series.
- BS 7671 (IET Wiring Regulations) requirements for maintenance gangways

Ensure that the requirements of the following documents are met:
- Space and Weight Allowances for Building Services Plant - Inception Stage Design. BSRIA. TN 9/92.
- Space Allowances for Building Services Distribution Systems - Detailed Design Stage. BSRIA. TN 10/92.

Ensure that sensors are installed correctly in order to give representative readings.
Ensure that reference labels are attached to each control device.

310.097 GENERAL REQUIREMENTS - DESIGN FOR MAINTAINABILITY:
Ensure that a full O&M manual is prepared which reflects any system changes made during the installation and commissioning stages.
Ensure that adequate access to BMS equipment and components is provided.
Ensure that all components and wiring are identified by a consistent numbering system

310.100 GENERAL REQUIREMENTS - SYSTEM SUPPORT:
Ensure that a viable strategy is in place to fully support the BMS for a minimum of 10 years from the date of practical completion.

310.110 OPERATOR CLIENT / SERVER - OPERATIONAL CHARACTERISTICS:

Ensure that the control of plant is independent of the operator workstation.

Ensure that no data of a control nature is transferred between field controllers via the client / server, i.e. data relating to control strategies.

Ensure that the client / server can communicate with all addressable field controllers.

Provide complete system integrity such that the network of field controllers will continue to fully operate following a failure of the client / server.

Ensure that the appropriate control strategy configuration data can be downloaded to all addressable field controllers.

Provide a means of displaying and modifying each addressable field controller's control strategy, time schedules and set-points via the client / server.

Allow the operator to re-schedule plant operation times. Ensure that re-scheduling can be applied globally to a number of items of plant at one or more sites (or one or more controllers on one site) as selected by the operator.

Ensure that the client / server incorporates a data storage management system that warns against impending on-line storage overflow and allows for data archiving to, and retrieval from, off-line non-volatile media. Ensure that the operator is prompted at pre-defined intervals to carry out the data archiving procedure.

Ensure that it is possible to perform a complete backup of the plant comprising control strategies, set-points and logged data to the server.

Where neither network-attached storage (NAS) storage area network (SAN) or cloud storage are utilised to backup purposes by the system, provide an electronic data archival device that uses readily available non-volatile media that is appropriate for long term storage of system software, configuration data and logged data (including alarm data).

Allow the transfer of data from the system memory and other storage devices to the archive mediums, and vice versa for the preparation of reports.

Ensure that the system can be fully restored from backup data..

310.115 BMS SERVER EQUIPMENT:

Refer to scope of works for detailed requirements.

Standards

BS EN ISO 16484-3
BS EN 60950-1
BS EN 62368-1

Approach - Physical server unless detailed otherwise in scope of works

Administrator interface by Remote desktop, or Local user interface or UK QWERTY keyboard.

Ensure that the processor speed of each server (or server farm) meets the data processing requirements.

310.121 CLIENT DISPLAY EQUIPMENT:

Supply and install a head end PC or PC's as specified in the scope of works and in the locations described in the scope of works or as indicated on the drawings.

Standard - BS EN ISO 16484-2, BS EN 60950-1, BS EN 62368-1

Client

PC, or Laptop or mobile device as detailed in the scope of work / system description.

Processor

Ensure that the processor speed of each client meets the data processing requirements.

Ensure that the processor speed is such that any significant delays in processing system are eliminated.

User Access

Provide a UK QWERTY keyboard with full upper/lower case ASCII key-set, numeric keys and mouse. Where required Incorporate a touch-screen facility in place of a keyboard. Where this is the case also provide a keyboard connection and associated functionality.

Tenderers to confirm with tender make and specification of equipment they are proposing for each of the operator facilities.

310.125 PRINTER(S):

Standard

BS EN 60950-1

BS EN 62368-1

Ensure that the printer can print all monitored and logged data (including graphs of logged data); all point data (hard and soft); control logic and plant/building schematics in colour; alarm data/text; and system help text.

Ensure that the automatic printing of alarm data can be switched on/off.

Ensure that alarm data can be routed to specific clients and/or individual operators as identified by their specific logon information.

Ensure that the printer has a minimum output of four pages per minute.

310.131 SYSTEM MONITORING AND LOGGING FUNCTIONS:

Ensure that all monitored point data can be displayed at the client. Ensure that analogue, digital and soft-points can be displayed simultaneously.

Ensure that all changes made by the operator (eg set-point changes) can be logged and identified by both operator and date/time stamp.

Provide a facility to allow the display, at the client, of 'real time' data superimposed on plant schematics with a refresh rate not exceeding 20 seconds.

Ensure that a minimum of six 'real time' data points can be displayed simultaneously, in the form of data plots, with a time delay not exceeding 20 seconds.

Provide a facility to allow the monitoring and display, on the same 'page', of common criteria/plant functions.

Ensure that any hard or soft-point log can be displayed and stored on the client.

Ensure that logs can be set up from the client and that logging times and logging intervals are user adjustable between 1 second and 24 hours or when the value changes by an amount greater than an adjustable hysteresis threshold.

Provide central operator facility with the ability to select points to be logged by the system.

Total number of logging channels available for each outstation not to be less that 20% of the total physical points on that outstation or as indicated.

Outstation memory shall be sufficient to log the equivalent of 5 days data at 15 minute intervals for 20% of the total number of physical points on the outstation.

Flexibly allocate logging memory to the points selected including to "soft" or "virtual" points.

When a log is set up allow for the following

: error indication if the maximum logging channels are exceeded

: the ability to specify the frequency and duration for which the data value is to be stored.

Each logged value shall be associated with

: point reference

: unit of measurement

: date and time measured

The system shall be able to export this information to other software packages including Microsoft Excel and Word format.

Provide a facility to allow the simultaneous display of different logged data. Ensure that this function is operator adjustable.

310.141 GRAPHICAL USER INTERFACES:

Comply with relevant standards including the following where appropriate.

BS EN 61082-1 for general schematic and information presentation

BS EN 60073 for indications and actuator states

ISO 7000/IEC 60417-series, IEC 60617 and ISO 14617-series for symbols in general.

BS 1553-1 for piping systems and plant symbols and schematics

BS 1553-2 for power generating plant symbols and schematics

BS 1553-3 for compressing plant symbols and schematics

BS 1635 for fire protection system symbols and schematics

BS 4737-5.2 for intruder alarm system symbols and schematics

BS EN 1861 for refrigerating system and heat pump symbols and schematics

Provide graphics as defined in the scope of works. The graphics shall be dynamic, and to show the following

as a minimum.
Water and air temperature set points, and actual values, valve and damper positions, filter status, minimum and maximum air flows in VAV systems, plant operational status (ie on/off/alarm), metering actual data.
Provide a software library of plant schematics and symbols, the format/contents of which should be confirmed with the specifier based on samples.
Provide a facility to allow the operator to generate additional schematics and symbols using readily available drawing formats.
Ensure that the system can accommodate the addition of 20% extra graphics 'pages'.
Provide a facility to allow the operator to modify plant schematics and to generate new ones. New elements for schematics to be available on a Tool Palette and the association with data points in controller outstations to be made using drag-and-drop.
Ensure that graphics can be displayed in a layered approach (building layout graphics down to plant subsystems and components). Ensure that the operator can modify the structure of the layered approach.

310.150 USER INTERFACE - HELP AND ASSISTANCE:
Provide a facility to allow the display of help text covering all operator functions and system fault conditions.
Provide a facility to allow the display (including a hard copy) of points list (hard and soft-points) and control strategy logic schematics.

310.160 INTEGRATION WITH THIRD PARTY MANAGEMENT SOFTWARE:
Energy monitoring and targeting software
Provide a facility to allow the direct transfer of recorded energy consumption and external air temperature readings from the BMS to the monitoring and targeting software. Ensure that real time data is available in a standard database format (e.g. SQL, ODBC, etc).

Maintenance management software
Provide a facility to allow the direct transfer between the BMS and the maintenance management software of plant run hours; number and frequency of plant starts; critical alarms requiring immediate attention; and maintenance (non-critical) alarms.
Ensure that real time data is available in a standard database format (e.g. SQL, ODBC, etc).

310.170 SYSTEM ALARMS:
Standards
BS EN 62682
Engineering Equipment and Materials Users Association publication No. 191 “Alarm Systems: A Guide to Design, Management and Procurement”.
Ensure that alarms are displayed on a rolling basis in chronological order.
Ensure that the operator can acknowledge alarms, including muting of audible or flashing annunciators.
Provide a facility to silence audible alarms or inhibit flashing annunciators without performing alarm acknowledgement.
Ensure that alarms can be inhibited for reasons of time and/or priority as selected by the operator.
Ensure that the BMS can be configured to avoid fleeting alarms, i.e. ensure that alarms can accommodate start-up and shutdown delays.
Ensure that the operator can alter the limits at which the measured values cause alarms to be triggered.
Ensure that alarms can be limited to the source items(s) of plant.
Ensure that alarm limits can accommodate sliding limits, e.g. set-point changes.
Ensure that alarms can be differentiated by means of alarm type and identification.
Ensure that alarms can be prioritised (including a high priority that will be annunciated regardless of other activity) and a low priority or information status that is only annunciated on demand.
Ensure that the time taken to receive alarms does not exceed 5 seconds
Ensure that visual, audible and printed annunciation of alarms, or any combination of these, can be selected by the operator.
Ensure that the reception and acknowledgement of alarms can take precedence over other operations. However, ensure that the reception of alarms does not hinder user log-in.
Allow the user to acknowledge alarms individually and on a group basis. Acknowledgement should include muting or flashing annunciators.

Provide distinction between active alarms whose conditions are not cleared and unacknowledged alarms.
Provide an alarm-latching facility with manual reset.
Ensure that alarm data provides condition identity; condition value; alarm source; alarm time and date; and acknowledgement status.
Ensure that the alarm file can be sorted by the above criteria.
Allow alarms to be automatically redirected to other user interfaces.
Provide sufficient data storage capability for the storage of alarms.
Ensure that any stored alarm data can be analysed in conjunction with other monitored conditions or stored logged data.
Ensure that an alarm review facility is available.
Allow the display of stored alarm data based on user definable selection criteria.
Ensure that the operator can define the requirement for acknowledgement of alarms; a time programme for annunciation of alarms to different destinations; and text messages associated with alarm conditions.
Ensure that critical alarms can be relayed by SMS text message and/or email to a distribution list of operators. The definition of a 'critical alarm' is to be wholly adjustable by the administrator.

310.175 FIELD CONTROLLERS - GENERAL:

Standard

BS EN ISO 16484-2 for hardware
BS EN 15500-1 for electronic individual zone equipment

Casing material – rigid plastic

310.180 FIELD CONTROLLERS - MODES OF OPERATION:

Ensure that the field controllers perform all control actions independently of the operator workstation.
Ensure that all field controllers can operate independently and in real time following a failure of the BMS communication network.
Ensure that field controllers can operate with the loss of shared data through the use of default values and final data reading before the loss of network communications.
Provide operator interfaces

310.190 FIELD CONTROLLERS - PHYSICAL CONSTRUCTION:

For internal plant room applications, construct field controller enclosures to give a minimum degree of protection to IP54 in accordance with BS EN 60529. Where the field controller is fitted inside a control panel that is protected to IP54 then the field controller protection can be reduced to IP41. For external applications, construct field controller enclosures to IP65.
Where an enclosure is to be provided ensure that field controller enclosures are lockable.
Ensure that modular construction is used for field controllers. Ensure that this allows the removal and replacement of devices without the need for rewiring of field wiring.
Ensure that I/O modules can be removed and replaced without the need to power down the entire modular system (i.e. I/O modules are hot-swappable).

310.200 FIELD CONTROLLERS TERMINATIONS:

Use terminals of the screw down clamp-type fixed to purpose made mountings.
Segregate into groups terminals of different voltage bands (in accordance with BS 7671).

310.220 FIELD CONTROLLERS - CONTROLLER INPUTS:

Ensure that the interfaces for the field controllers are appropriate for gathering data from sensors and devices.
Ensure that the following requirements are met.

Universal inputs

Variable currents (4-20 mA), variable voltages (0-10V), variable resistances or volt-free contacts.
Ensure that the scaling tables, necessary to process inputs configured as type analogue, are resident at the field controller.
Ensure that a minimum and maximum limit value can be defined for each analogue input. Ensure that each limit is associated with a configured response.
Ensure that the field controller can detect open or closed circuit faults and raise an alarm on the operator workstation.

Ensure that the configuration tables necessary to process inputs configured as type digital are resident at the field controller.

Ensure that the configuration tables necessary to process inputs configured as type multi-state are resident at the field controller

Digital inputs

As derived from volt-free contacts (max 24 volts/20mA). Allow the interface to be selected to monitor a normally open or normally closed circuit.

Ensure that the routines necessary to process the digital inputs are resident at the field controller.

Pulsed inputs

As derived from volt-free contacts (max 24 volts/20mA) at a pulse frequency of up to 32Hz.

Ensure that the routines necessary to process pulsed inputs are resident at the field controller.

Ensure that the field controller has the following capabilities.

Storage of cumulative totals daily; weekly; monthly; yearly; and continuously.

Operator re-set facility of cumulative totals via the operator workstation.

Facility to combine counts from separate pulsed inputs.

Ability to calculate the number of pulses per unit time through addition and/or subtraction.

Ability to compare the number of pulses with preset limits on the basis of total number of pulses per unit time and the time required for a total number of pulses.

Ability to convert pulsed readings into quantifiable values.

Alarm facility based on a user-defined limit being exceeded.

Ensure that the inputs which are used to monitor fluctuating pulse rate (eg maximum demand meter for electricity) have operator adjustable limits.

Ensure that when data for pulsed inputs is recorded, the record includes both the pulse count and logging intervals for cumulative counts.

Run-time totals

Include run-time totalling routines to enable the operator to record cumulative run-time for each item of plant selected.

Provide the operator with the option to set a different maximum run-time for each item of plant selected.

Ensure that when the maximum run-time has been reached an alarm is signalled to the operator.

Ensure that the operator workstation can be used to interrogate field controllers for a point-by- point summary of run-time totals and run-time limits.

Ensure that it is possible for the user to set an initial value of hours run other than zero.

General

Ensure that all inputs can be scanned at intervals not exceeding 1 second.

Refer to the scope of works / schedules for any special requirements for time-critical control applications.

Ensure that all inputs are protected against spurious out-of-range signals including those caused by contact noise or bounce.

Ensure that errors introduced by the analogue to digital conversion of inputs do not exceed 0.1% of the analogue value.

310.230 FIELD CONTROLLERS - CONTROLLER OUTPUTS:

Ensure that isolation between controllers and networks meet the requirements of BS EN 63044 - series.

Ensure that the field controllers' interfaces are capable of providing control signals to actuators and switching devices.

Ensure that routines are configurable, such that one or more events may be enabled in direct response to any defined logical relationship between the status of a number of physical or soft- points.

Ensure that in the event of power failure, output devices can be driven to their preset, fully open/closed position.

Provide the following interface characteristics:

Analogue output. As variable currents (4-20mA) or as variable voltages (0-10V). Ensure that it is possible to characterise analogue outputs in order to obtain a near linear response from the controlled items of plant.

Digital output. Ensure that digital outputs can be selected as 'normally closed' or 'normally open'.

Ensure that errors introduced by the digital to analogue conversion of outputs do not exceed 1 LSB.

Ensure that the field controller is capable of receiving feedback signals which allow the comparison between an output signal to a controlled device and its actual condition.

310.240 FIELD CONTROLLERS - POSITIVE FEEDBACK:

Ensure that the field controllers can include routines necessary to confirm that specific items of plant are functioning correctly. Ensure that this can be performed by monitoring physically separate but functionally related sensors, switches or transducers.

Ensure that an alarm is raised if the expected response has not been established by a pre-set time following switching on of plant. Ensure that it is possible to operate any specified standby plant. Provide the operator with a facility to adjust the pre-set time delay.

Ensure that the field controllers are capable of using measured feedback from an actuator position to give a percentage open reading.

310.250 FIELD CONTROLLERS - DATA MONITORING AND LOGGING:

Ensure that hard and soft-points associated with a field controller can be logged.

Ensure that the BMS operator can set the start/stop times and logging frequency at the operator workstation.

Ensure that logging is selectable between fixed periods or on a rolling basis.

Ensure that each log can be defined in terms of log identification (point identification); units; and date/time stamp.

Ensure that the operator can select all physical and soft-points for logging.

Ensure that the field controller has sufficient memory to log the equivalent of seven days data at 15 minute intervals for 50% of the total number of physical points on the field controller.

Ensure that the log data is to be automatically uploaded to the operator workstation / system server and stored in a standard database format (e.g.SQL, ODBC).

310.260 FIELD CONTROLLERS - ENVIRONMENTAL CONDITIONS:

Ensure that field controllers are suitable for operating normally within the following environmental ranges:

Temperature 0 to 50°C

Relative humidity 10% to 90% non-condensing.

Ensure that the field controllers will operate in the electrical environment associated with building services plant rooms.

Ensure that the field controllers are protected against the effects of moisture, dust, dirt and gases.

310.271 FIELD CONTROLLERS - INTERNAL POWER BACKUP:

Provide internal power backup

Ensure that a rechargeable battery or capacitor, if specified, can hold the controller's volatile memory for a minimum period of 72 hours.

Ensure that a non-rechargeable battery, if specified, can maintain the controller's clock function for a period of two years.

Ensure that the battery is easily replaceable.

Ensure that the interval between battery maintenance inspections is not less than 12 months.

310.280 FIELD CONTROLLERS - MEANS OF CONFIGURATION:

Ensure that the field controllers can be fully configured directly via a laptop type computer and via the operator workstation.

Ensure that the field controllers can be configured through the use of a configuration interface with full upload and download capability.

Ensure that configuration details can be easily altered by system operators.

Ensure that access to make configuration alterations is restricted to operators with access authority through the use of passwords.

Ensure that any battery monitoring functions defined in the Particular Inspection can be met.

310.291 FIELD CONTROLLERS - USER INTERFACES:

Ensure that all field controllers can be accessed through the use of portable computers.

Ensure that access allows the display of all configuration details associated with the field controller along with:

Password protection for access with a minimum of two access levels.

Ability to display all point data (both hard and soft).

Ability to initiate and display logged data.

Ability to display and alter set-points and time schedules.
Ability to make alterations to control strategies.

As defined in the scope of works or schedules provide a panel-mounted operator interface to interrogate the field controllers. Ensure that the interface includes the ability to:

Provide password protection for access with a minimum of two access levels.
Display all physical point data.
Display and alter set-points and time schedules.
Display the current date and time.
Review and acknowledge alarms.
Display logged data in graphical format, with overlaying of up to 8 logs on a single graph.

310.295 DEDICATED CONTROLS - OPTIMISERS:

Standard - BS EN 12098-2.

310.296 DEDICATED CONTROLS - COMPENSATORS:

Standard - BS EN 12098-1, BS EN 12098-3

310.297 DEDICATED CONTROLS - TIME SWITCHES:

Standard BS EN 60730-2-7.
Provide time switches with minimum of 24 hours mains failure reserve facility.

310.301 OCCUPANT CONTROLS - GENERAL:

Ensure that the specified occupant controls can be linked to, and communicate over, the BMS communications network.
Ensure that the occupant controls can control the relevant items of plant.
Ensure that the status of each occupant controller can be viewed and overridden via the operator workstation.
Ensure that each occupant controller has a service port available that allows a laptop type computer to be connected using a suitable wired service tool. It shall be possible to disable the service port function via the password protected configuration settings for the occupant control.
When connected using the service port all controllers in the entire BMS network are to be accessible via the laptop type computer.
Ensure that the occupant controls allow:

Adjustment by the occupants of the set-points.
Definition, and adjustment by the BMS operator, of high and low limits for each set-point control.

Provide a facility to allow the global alteration of set-point and high/low limits via the operator workstation.
Provide an override facility to allow plant operation during out of hours occupation.
Ensure that the occupant controls are intuitive to use and clearly labelled.
For temperature control ensure that hot/cold and/or red/blue indication is used for the occupant interface.
For fan speed control ensure that fan fast/slow indicators are used.
Ensure the +/- symbols are not used without clarification of the controlled function.
Wall/desk mounted

310.320 OCCUPANT CONTROLS - OFFICE IT/INTRANET BASED:

Ensure that the occupant controls are TCP/IP compatible.

310.330 CONTROL FUNCTIONS AND ROUTINES - GENERAL:

Provide a facility to automatically cycle selected actuators through their full range of movement outside normal operating periods with a periodicity set by the operator (in addition to normal automatic or manual control). Ensure that the cycle finishes as one complete operation. Ensure that any alarm conditions raised during the operation are inhibited as necessary.
Provide a facility to drive actuators to their open or closed positions at the end of plant operating periods.

310.340 CONTROL FUNCTIONS AND ROUTINES - BASIC CONTROL FUNCTIONS:

Ensure that configuration routines necessary for direct digital control (DDC) are resident at the field controllers.
Provide DDC of plant through algorithms giving proportional plus integral plus derivative control (PID).
Provide two-position control.

Provide raise-lower or three-point control.
Allow the selection of either proportional control (P) or proportional and integral control (P+I) or proportional and integral plus derivative control (P+I+D) modes independently for each relevant item of plant. Ensure that proportional, integral and derivative action times can be adjusted by the user.
Allow the combination of more than one control loop by 'cascading', i.e. using the output signal from one control loop as the input signal to another control loop.
Ensure control routines provide for bumpless transfer capability when switching from manual mode to automatic mode.
Ensure that the control routines are capable of controlling the individual plant items listed
Provide a comprehensive programmable facility using a simple and easy to use program strategy tool that allows comprehensive debugging and live editing of control strategies.
If a comprehensive programmable facility is not available then a micro function block based tool may be supplied providing the following requirements are met:

Provide logic modules covering
- Logical combination of digital variables.
- Logic timer module.
- Logic readback module.
- Logic counter module.
- Logic delay module.
- Logic hours run module.

Provide the following logic functions:
- AND.
- NOT AND (NAND).
- NOT OR (NOR).
- OR.

Provide the following function modules as a minimum:
- Filter (applies exponential filter with gain to input signal).
- Rescale from (rescales an input of 0 to 100 to a user defined output and limits at these values).
- Rescale to (rescales the input to the output of 0 to 100 and limits at 0 and 100).
- Limit at (limits the output at user specified values).
- Limit to (limits the output to 0 or 100 percent at values specified by the user).
- Logarithm of input; Square root of input; Add to input; Multiply by input; Divide by input.
- Minimum (to select the minimum value from two or more inputs);
- Maximum (to select the maximum value from two or more inputs);
- Average (to calculate the average value from two or more inputs).
- Analogue gate (digital signal switches output between two analogue input signals).
- Comparator (to compare two inputs, when input X is greater than input Y output of one is produced otherwise the output is zero).
- Enthalpy (to calculate the enthalpy value from a temperature input and humidity input).
- Hysteresis (changes a digital state if the input changes outside a defined band).
- Analogue to digital converter (to change analogue value to binary).
- Provide comprehensive debugging and live editing of control strategies.

Ensure that the program strategy tool (whether comprehensive or Macro function block based) is not restricted to the use of the systems integrator but is available for suitable trained administrators via the operator workstation.

310.350 CONTROL FUNCTIONS AND ROUTINES AND CONTROL INTERLOCKS:

Ensure that the BMS is capable of providing all control functions, routines and interlocks detailed in the scope of works, schedules and controls drawings.

Where the following standard control routines are required (as detailed in the schedules, scope of works or controls drawings) the BMS shall be capable of providing the functions detailed in BSRIA Application Guide AG 9/2001. (Part A clauses 5.3 to 5.11 inclusive)
- Frost protection (see clause 310.351)
- Building/plant protection

Safety interlocks
Time schedules
Plant start/stop control
Sequence control
Plant rotation control
Optimum start for heating and cooling systems
Weather compensation
Lighting control

Safety interlocks
Ensure that all safety interlocks are hardwired and have precedence over all other control functions.
Ensure that safety interlocks can only be reset manually and locally (not from the operator workstation).
Ensure that all hardwired safety interlocks have corresponding software interlocks to prevent cascading nuisance alarms.
Ensure safety interlocks operate when plant selector switches are in 'Hand' or 'Auto' mode.
Ensure safety interlocks operate when frequency inverters are selected in 'Local' or 'Auto' mode at the inverter keypad.
Ensure safety interlocks comply as appropriate with:
BS EN 61508-series for control of systems where an assessed safety integrity level is required.
BS EN 13850 for design of emergency stop functions.

Variable volume pumped systems
Control strategy to include regime to fully open and close all 2 port valves in the system on a timed basis to ensure water treatment chemicals are circulated through all terminal units on a regular basis.

310.351 FROST PROTECTION OF BUILDING SERVICES SYSTEMS AND BUILDING FABRIC
Provide frost protection routines to operate plant, pumps and / or fans and necessary control valves in order to protect building services systems and their components from frost damage.

Provide the following two stages of protection:

When the outside temperature falls to the operator set minimum frost-protection temperature, the selected pumps start and circulation is established through pipework systems and their components including all air handling unit coils in locations where the outside air temperature could be below the minimum frost protection temperature. This shall include fully opening two port control valves and motorising 3 port control valves to flow to the coil. Allow the operator to pre-select which plant is to be started. The automatic standby plant is to operate on failure of the duty plant.

Ensure that when the return temperature falls below the operator pre-set minimum, the full frost-protection facility is initiated. Ensure that for heating systems, the heat source is turned on and operated to maintain the return flow temperature above the pre-set minimum. Ensure that specified protective devices activate for other liquid systems.

Provide a facility to allow frost protection to be logged together with data and time.

Provide protection routines to operate the plant in order to protect the building fabric and its contents against the effects of low internal temperatures and of condensation.
Ensure that if the internal air temperature falls below the pre-set protection temperature, the heating system and related plant is turned on and heat supplied to maintain the air temperature at or above the protection set-point temperature.
Ensure that the building/plant protection routine overrides other control functions unless otherwise specified.
Ensure that protection operates whenever the normal heating is switched off.

310.440 SYSTEM COMMUNICATIONS - GENERAL:
Ensure that the system communications allows the full transfer of monitored, logged, alarm, backup and configuration data between the operator workstation and addressable field controllers.
Ensure that the communication protocol selected seeks to achieve error-free data transfer. Ensure that the

protocol includes an error detection check; includes an error correction and/or re-try technique; limits re-transmission; and raises an alarm condition on failure.
Ensure that the available bandwidth is sufficient to avoid excessive delays in transmitting data

310.450 SYSTEM COMMUNICATIONS - COMMUNICATION DEVICES:
Ensure that connections to telecommunication systems complies with BS 6701.
Provide an ADSL link.

310.460 SYSTEM COMMUNICATIONS - COMMUNICATIONS PROTOCOLS:
Arrange the digital data interchange systems using open system protocol.
Possible applicable standards – refer to scope of works for details
- BS EN 61158-2 (fieldbus).
- Profibus (BS EN 62769-series)
- Profinet (BS EN 62769-series)
- Modbus
- Modbus over Ethernet
- KNX (BS ISO/IEC 14543-series)
- BS EN ISO 16484-5 (BACnet)
- BS EN 14908-1, BS EN 14908-2, BS EN 14908-3 and BS EN 14908-4 (LonWorks).
- Metering data exchange:
  - Smart metering:
    - BS EN 62056-series Electricity metering data exchange
    - BS EN 50491-11 HBES smart metering user display
    - PD CEN/TR 16061 smart gas meters
    - PD CEN/CLC/ETSI TR 50572 Functional reference architecture for communications in smart metering systems
- PD CLC/TS 50568-4 and PD CLC/TS 50568-8 Electricity metering data exchange
- BS EN 61968-9 system interfaces for utility metering interface and control

Ensure that the selected field level protocol can:
- Run on the required communications media.
- Provide a communications throughput sufficient for the intended application.

Provide appropriate network topology options.
- Allow sufficient maximum physical segment length.
- Allow sufficient maximum number of nodes for each physical segment and the logical network.
- Provide sufficient maximum distance between nodes.
- Make use of off-the-shelf network devices such as repeaters, bridges and routers.

Allow control devices to be powered from the network if defined in the scope of works
Ensure that the protocol is compatible with fully developed network configuration and management tools.

310.470 SYSTEM COMMUNICATIONS - DIRECT INTEROPERABILITY:
Ensure that each of the protocol's objects and attributes are consistent with the achievement of the specified level of direct interoperability.
Ensure that each of the protocol's arrangements for physical connection, data packaging, network management and error detection/correction are the same.

310.480 SYSTEM COMMUNICATIONS - GATEWAYS:
Ensure that the gateway can
- Transfer the specified maximum number of points.
- Limit loss of functionality to the level specified.
- Add functionality where specified.

Ensure that the specified contingency and alarm measures in response to a failure of the gateway are met.
Ensure that the gateway can be modified in response to any future changes relating to the type and amount of data transferred over it.
Clearly define who has contractual responsibility for the implementation of the gateway.

310.490 SENSORS AND DETECTORS - GENERAL:

Ensure that all signals are compatible with interfaces fitted to associated field control devices.
Ensure that the performance of the sensors and detectors are not adversely affected by variations in power supply conditions in accordance with BS EN 50160 (with additional voltage drop in the electrical installation defined in BS 7671), or by anticipated conducted and radiated electromagnetic disturbances for the electromagnetic environment in which the sensors and detectors are to be used.
Ensure that connections to sensors and detectors are of a screw down clamp type or self-locking connectors.
Ensure that sensors, detectors and meters are installed in accordance with the manufacturer's instructions and recommendations.
Ensure that calibration conditions for meters are fully documented in the O&M manuals and clearly marked on or adjacent to the meters.
Ensure that any calibration and maintenance requirements for sensors, detectors and meters are documented in the O&M manuals.
Interface detectors and sensors with controllers and indicators via amplifiers or transmitters, where necessary.
Provide calibration certificates for all sensors used on projects where there is a validation requirement.

310.500 SENSORS AND DETECTORS - TEMPERATURE SENSORS:
Standard BS EN 60730-2-9 and BS EN 14597 where appropriate.
Sensors shall not drift by more than 0.1 °C per year, and have a hysteresis value of less than 0.05%.
Off/On thermostats for general applications shall be metal with sensor accuracy of +/- 0.5 °C and volt free contacts for derivation of low voltage status signals
Time constant
Space/outside air temperature - 300s still air.
Duct air temperature - 120s @ 1m/s.
Water - 30s @ 1m/s.

Ensure that temperature sensors comply with the minimum requirements of the following table.

Temperature sensors - minimum requirements

Fluid	*Temperature range °C*	*Sensor accuracy °C*
Air	-10 to +40	+/- 0.5
Flue gas	+30 to + 850	+/- 3.0 (0.75% of FSD above 450^{0}C)
Chilled Water	-10 to + 30	+/- 0.25
Water	-10 to +150	+/- 0.5

310.501 AIR THERMOSTATS - ROOM TYPE:
Standard - BS EN 60730-2-9.

310.505 AIR SENSOR - INSERTION TYPE:
Use proportional type insertion sensor.
Sensor

Averaging type temperature sensor for mounting overface of air flow in an air-handling unit or in ductwork adjacent to a heating coil.

Thermistor type temperature sensor, minimum stem length 200mm for mounting in the air flow or distribution ductlines.

310.510 SENSORS AND DETECTORS - HUMIDITY SENSORS:
Standards - BS EN IEC 60730-2-13
Provide humidity sensors as follows:

no need to recalibrate within a period of at least 12 months
response time of less than 30 seconds
hysteresis value of less than 3% of the measurement range
drift not exceeding 5% of the measurement range per year
useful life span of not less than 3 years

Ensure that humidity sensors comply with the minimum requirements of the following table.

Humidity sensors - minimum requirements

Sensor	*Humidity range*	*Sensor accuracy*
Humidity	10 to 90%	+/- 5% RH

310.520 SENSORS AND DETECTORS - AIR VELOCITY SENSORS:

Standard - BS EN 60730-2-15.

Ensure that air velocity sensors comply with the minimum requirement of the following table.

Air velocity sensors - minimum requirements

Sensor	*Sensor range*	*Sensor accuracy*
Pitot static tube	3 to 80 m/s	+/- 2% of reading
Thermo-electric anemometer	0 to 20 m/s	+/- 3% of reading or +/- 0.1 m/s whichever is greatest

310.530 SENSORS AND DETECTORS - AIR PRESSURE SENSORS:

Ensure that air pressure sensors are manufactured from stainless steel and comply with the minimum requirements of the following table.

Air pressure sensors - minimum requirements

Sensor	*Sensor range*	*Sensor accuracy*
Air pressure	-	+/- 2% of reading

310.535 SENSOR AND DETECTORS - FLOW SENSORS:

Standard – BS EN IEC 60730-2-15 or BS EN 60730-2-15.

310.540 SENSORS AND DETECTORS - FLOW METERS:

Ensure that meters comply with the minimum requirements of the following table.

Flow meters - minimum requirements unless scheduled otherwise.

Meter	*Meter range*	*Meter accuracy*
Fuel flow meter	0 to 10 Hz	3% of reading
Water flow meter	less than 5:1	2% of reading
Electricity meter	-	1.5% of reading

Where a meter is used to measure the amount of energy supplied for billing purposes, the meter must be approved and stamped by NMO (National Measurement Office) or approved under the European Measuring Instruments Directive (MID 2004/22/EC).

310.545 SENSORS AND DETECTORS - LEVEL SENSORS

Provide level detectors as indicated.

Use stainless steel capacitance electrodes with PTFE insulation for liquids with minimum conductivity of 0.01 S/m.

Use stainless steel conductivity electrodes.

Use float type to BS EN IEC 60730-2-15 or BS EN 60730-2-15.

Provide indicator showing measured value at sensor. Calibrate indicators.

310.546 SENSORS AND DETECTORS – OTHER SENSORS:

CO sensors

BS EN 50291-1 for manufacture and testing of detectors designed for domestic premises.

BS EN 50292 for selection and installation of detectors in domestic premises.

CO_2 sensors.

- Operating principle – NDIR (non dispersive infra red)
- Measurement range – 0-2000 ppm, numerical resolution 1ppm
- Accuracy - +/- 1% measurement range; +/- 5% of reading (within +/- 10^0C calibration temp)
- Annual zero drift - <=/- 0.3% measurable range
- Response time – 20s with tube connection at 0.1l/min
- Operating temperature 0-50^0C

Combustible gases

BS EN 50271 for apparatus using software and/or digital technologies and BS EN 50194-1 for combustible gases in domestic premises.

Equipment for use in explosive atmospheres to be in accordance with BS EN 60079-29-1 and installed in accordance with BS EN 60079-29-2

Toxic gases

Design, performance functionality and testing in accordance with BS IEC 62990-1

BS EN 50271 and relevant parts of BS EN 45544 series for electrical apparatus for the detection and measurement of toxic gases using software and/or digital technologies.

Oxygen

BS EN 50271 and BS EN 50104

310.550 SENSORS AND DETECTORS - SENSOR TIME CONSTANTS:

Ensure that the following sensor time constants are met.

Table 6 BSRIA AG9 Sensor time constants

Measure medium	*Time constant*
Space/outside air temperature	300s still air
Duct air temp	120s @ 1m/s
Water	30s @ 1m/s
Relative humidity	300s @ 1m/s
Light	Instantaneous
Flow - water	5s
Flow - liquid fuel or gas	5s

310.555 TRANSMITTERS:

Use transmitters to interface between sensor and controller, utilizing only one sensor.
Resistance thermal device (RTD) to BS 1041-3
Resistance thermal device (RTD) to BS EN 60751.
Thermocouple to BS EN 60584-series type .

310.561 AIR FLOW VELOCITY SENSORS / DETECTORS

Where indicated, provide multi - point, integrating measuring devices in ductwork.

The units shall be suitable for the level of filtration to be provided and complete, comprising as a minimum,

a frame work to allow it to be built into the ductwork system,

all transducers, signal processors etc, to enable it to produce a signal in a form required by the BEMS (0-10 V, 4-20mA).

in-built calibration equipment for any on board electronics

display of the sensed flow at the grid

The number of sensing points shall be capable of measuring the flow to an accuracy of +/- 5% of the sensed system volume (over the full range of operating volumes on variable volume systems) to a minimum velocity of 1.5m/s..

310.610 AIR THERMOSTATS – ROOM TYPE

Standards BS EN 60730-2-9; Type as indicated and to suit application.

310.640 AIR THERMOSTATS - FROST PROTECTION TYPE:

BS EN 60730-2-9.
BS EN 14597

For space mounting use frost protection thermostats with temperature range of 0-20ºC and with SPST switching action and electrical rating of 20 amps resistive.

For heater battery protection use frost protection thermostats consisting of a gas filled sensing element and a bulb, a directly adjustable set point and switching differential.

For compensated systems use external frost type thermostats with proportional type sensor, the whole unit being weather-proofed.

Ancillaries

Start up switching and indication
Manual or automatic reset facility as detailed in the scope of works or control strategy diagrams.

310.645 WATER IMMERSION THERMOSTATS:
Standards - BS EN 60730-2-9, BS EN 14597
Use proportional type immersion thermostats with rigid sensing elements ensuring 50mm minimum length is immersed. Use separable pockets, screwed 15mm BSP.
Install pockets in positions indicated.

310.650 HUMIDISTATS:
Differential – 4% RH
Accuracy – 3% RH

310.700 ACTUATORS:
Include position feedback devices suitable for connection to the BMS.
Ensure that actuators incorporate a disconnection device to allow manual operation of the valve or damper in the event of actuator failure.
Where line voltage actuators are used, provide local means of isolation by manual isolator or plug and socket connection.

310.705 ACTUATORS - SOLENOID TYPE:
Standard - BS EN 60730-2-8 for electrically operated water valves up to DN 50.

310.710 ACTUATORS - ELECTRONIC TYPE:
Standards
BS EN 60730-2-8 for electrically operated water valves up to DN 50.
BS EN IEC 60730-2-14 for electric actuators
BS EN 1349 and relevant parts of BS EN 60534 for actuators fitted to industrial process control valves from DN 15 up to DN 1200.
Use low voltage, high torque, electronic type actuators, including mounting brackets, adjustable linkages and necessary attachment devices.
Control mode – as described in controls narratives
Actuators, together with linkages, shall operate smoothly from fully open to fully closed positions without binding and with adequate torque to overcome resistances of bearings and fluid flow.

Clearly mark linkages with clamping position so that after maintenance or replacement the mechanism can be easily restored to its correct operating position.
Fit visual position indicators.
Electrically and mechanically protect actuators against the effects valve or damper seizure.
Incorporate disconnection device to allow manual operation in the event of actuator failure.
Where indicated or necessary for correct system operation provide a position feedback device connected to Controls/BMS.

310.716 ACTUATORS - ELECTRIC MOTOR:
Standard
BS EN IEC 60730-2-14 for electric actuators
Provide thermal overload protection with manual reset option.
Electrical requirements
Integral terminal strip or DIN plug and socket connections C/W two end of travel limit switches, with adjustable cam operation for motor de-energisation.
Mechanical requirements
Manual override, geared to prevent backdrop, position indicator.
Enclose to IP65 minimum.

310.805 MOTORISED VALVES / ACTUATORS:
Type – As described in controls narratives

Standards
BS EN 60730-2-8 for electrically operated water valves up to DN 50
BS EN 1349 and relevant parts of BS EN 60534 or BS EN IEC 60534 for industrial process control valves from DN 15 up to DN 1200
Pressure Independent Control Valve (PICV) - tested in accordance with BSRIA BTS 1/2012.
Ancillaries

Position indicator, Locking device, control device and linkage mechanisms and as required to match control function

Actuating motive power - to match control system

Valve/actuator combinations shall be capable of closing off fully. In the case of 2 port control, this shall be against the full closed head of the installed pump.

General ancillaries - Positioners, locking device and lever for manual operation / control failures

The failure position of control valves shall be as follows:
Humidifiers, heating to HWS calorifiers, and items fed by steam- closed to load (i.e. spring return)
Heating and cooling coil and frost protection - open to the load or mid-position
Others - mid-position

310.905 MOTORISED DAMPERS AND SHUTTERS:
Use motorised control dampers manufactured and installed in accordance with DW/144.

310.906 RELAYS:
Use demountable relays of the totally enclosed type having at least one spare set of changeover contacts.
Electrical terminals to be shrouded and screw down clamp
Provide indicator tags/LEDs to indicate energised state. Provide manual actuation for test purposes.

320.000 INSTALLATION

320.050 FIXING AND CONNECTION - CABLING
Plan and install all building management monitoring systems cables in accordance with the cable manufacturer's recommendations.
Label and record all monitoring cables
General

This part of the specification covers extra-low voltage wiring (as defined by BS 7671), i.e. signal and data communications wiring. For power wiring refer to relevant “Y” sections of this specification.

Install all cabling in accordance with BS EN 50173-series, BS EN 50174-series and BS 7671 (IET Wiring Regulations).

All cabling must be adequately protected from the environment through which it passes to avoid the possibility of mechanical damage and electromagnetic interference.

Install cabling and conduits associated with sensors in a manner that prevents spurious transfer of moisture and heat etc from external sources to sensing devices.

Ensure that all wiring is carried out in a neat manner by skilled operatives. Clip wiring to form a loom and route it to avoid interference with the correct operation or maintenance of other components.

Cable type and application

Ensure that the types of cable installed do not prejudice satisfactory operation of the BMS.

Ensure that the type of cables, installation and planning comply with the BMS manufacturers recommendations and the project's electrical specification.

Ensure that the cross-sectional area of cables is sufficient to ensure that sensor circuit resistance limits are not exceeded.

Ensure that the method of installation and routing of cables does not compromise the satisfactory operation of the BMS.

Ensure that the minimum separation distances between data/analogue signal cables and cables of other services (including) power cables comply as relevant with BS 7671 and BS EN 50147 series.

Identification

Ensure that all cables have identification sleeves at their terminations which combine the requirements of BS 7671 with those for specific circuit identification. Ensure that the identification is consistent with the relevant wiring diagrams.

320.060 FIXING AND CONNECTION - USE OF EXISTING CABLE AND WIREWAYS:

Confirm by testing or obtain appropriate certificates from original suppliers that any existing means of network communication is of a suitable standard for satisfactory operation of the BMS.

Ensure that any tests performed comply with relevant parts of BS EN 50174.

Ensure that the potential corruption of data cannot arise from:

- Other installations not connected to, but in close proximity to, the route of existing cabling
- Other electrical services using existing cabling
- Other adjacent cabling.

State in writing at the time of tender whether or not existing cabling is suitable.

320.070 FIXING AND CONNECTION - CONNECTION TO PLANT AND CONTROL EQUIPMENT:

General

Provide all devices and terminals necessary to connect the BMS to items of plant and control equipment. Take account of any existing services that have to remain in continuous operation. Provide for approval, an installation and commissioning plan that identifies how the BMS equipment can be installed an commissioned without disrupting the operation of the existing building services.

Where plant and control equipment are supplied by others, provide the adequate interface and integration (physical and functional) needs for installation and commissioning requirements. Provide this information in time and in sufficient detail to enable any other installers and their suppliers to incorporate the BMS connection facilities before delivering their equipment to site.

Where plant is subject to warranty by others, obtain clearances in writing from those concerned that the proposed modifications do not invalidate the warranties.

Ensure that modifications carried out as a result of the contract are fully documented and do not affect the satisfactory operation of safety devices connected to any plant or systems affected directly or indirectly by the BMS works. Carry out proving tests to the satisfaction of the Project Supervisor.

Ensure that the use of existing relays, contactors, starters and switches as part of the BMS installation is fully documented.

Safety interlocks

Provide interlocks as scheduled to establish and maintain safe/pre-determined plant conditions under all modes of operation including loss, reduction and restoration of power.

Ensure that all safety hard-wired interlocks are wired to failsafe on loss of power, or on relay coil failure, or on open circuit, eg cable breakage.

Ensure that all interlocks use voltage-free contacts and AC or DC 24V relays and field wiring.

Complete all wiring and testing of all hard-wired safety interlocks to ensure safe and/or sequenced operation of the plant before the BMS is set to work. Arrange interlocks to prevent unsafe or out of sequence operation of the plant by the BMS.

Ensure that plant does not operate using the BMS until all interlocks have been tested to the satisfaction of the Project Supervisor.

Manual control

Provide manual control facilities to enable plant maintenance/facilities staff to operate essential plant in the event of BMS failure and for routine test purposes. Ensure that the facilities include:

- Start/stop operation of the plant.
- Automatic operation of motorised control devices such as valves and dampers, etc if the BMS is operating.
- Manual setting of motorised control devices such as valves and dampers, etc if the BMS has failed.
- Ensure that the manual control facilities do not override safety devices or hard-wired interlocks.

Volt-free contacts

Ensure that the contact materials are suitable for use in the installation and at the required voltages and currents.

Use screw down or locking spade terminals for electrical connections to volt-free contacts.

Relays

Use demountable relays of the totally enclosed type.

Use relays with circuit arrangement printed on top.
Use screw down clamp or locking spade-terminals, and ensure they are shrouded.
Use relays with LED or flag indication of coil status.

.Signalling from starters

Provide additional contacts for signalling and remote operation purposes as scheduled

Control equipment

Obtain advice from the relevant supplier when additional facilities are to be fitted to control equipment supplied by others.
Use the knockouts, cable routes and terminals, etc incorporated into the design of control devices.

Packaged plant

Ensure that connections to packaged plant are made within the packaged plant control panel. Fit an additional enclosure where this is not possible. Ensure that all connections between the BMS and packaged plant are 24V maximum.

320.080 FIXING AND CONNECTION - ADDITIONAL PROVISIONS FOR RETROFIT INSTALLATIONS:

Arrange for any necessary control modifications to existing plant to be carried out by the original supplier (with the exception of starter panels). Give the supplier details of the requirements for connection of equipment to the BMS. State the name of the supplier in the Tender together with a priced schedule for the necessary work. Where details of existing plant are not available from the original supplier or from record documents, provide a specialist conversant with the particular type of plant to carry out any necessary modifications. Provide the specialist with the details of the BMS connections required. State the name of the specialist in the Tender together with a priced schedule for this work. Advise the Project Supervisor of any difficulties with connections. Advise in writing at the time of tender of any potential delay to the contract arising from the difficulty of providing the necessary BMS connections to the plant.
Use existing relays and volt-free contacts where feasible.
Fit auxiliary contacts to contactors, etc where adequate space is available. Install additional relays if the space is not adequate.
Obtain advice from the original supplier when additional facilities are to be fitted to existing control equipment. Use the control manufacturer's standard accessories to provide any additional contacts, limit switches and potentiometers, etc.
Use the knockouts, cable routes and terminals, etc incorporated into the design of control devices wherever possible. Obtain approval from the Project Supervisor for ad hoc fixings and modifications to control devices before action is taken on site.

320.091 CABINETS FOR BMS EQUIPMENT DESIGN AND CONSTRUCTION:

Construct BMS equipment enclosures to give the minimum degree of protection to IP54 and IP 55 in wet plant rooms, unless scheduled otherwise, in accordance with BS EN 60529. Where the enclosure is fitted inside another panel (eg a motor control center to IP 54 or 55) the protection can be reduced to IP41. For external applications, construct enclosures to IP 65 unless scheduled otherwise.
Ensure that access doors are of a rigid construction and mounted on stout metal hinges capable of supporting the full weight of the open door. Ensure that doors will not sag or drop when open. Fit doors with stout locking handles to prevent access by unauthorised personnel.
Allow safe access to the BMS equipment where the BMS equipment is incorporated into another control panel without having to isolate the panel.

320.101 CONTROL PANELS - DESIGN, CONSTRUCTION & INSTALLATION:

Refer to schedules or scope of works for control panel type, internal separation, input power supply and electrical ratings.

Standards

BS EN 63044-series for controllers
Relevant parts of BS EN 61439-series where the control panel forms part of switchgear and/or controlgear as defined in the standard
BS EN 60204-1 where the control panel may be considered to form part of machinery as defined in the Supply of Machinery (Safety) Regulation 2008 as amended
BS EN 60529 for ingress protection

BS 7671 (IET Wiring Regulations)
BS EN 62208 for enclosures

Control panel design

Ensure that the layout of control panels reflects the layout of the plant being served. Ensure that indicators and controls for associated plant are grouped.

Ensure that all doors on panels containing exposed dangerous voltages are provided with interlocked isolators such that the door cannot be opened except with the isolator in the 'off' position. Ensure that isolation complies with BS 7671 (IET Wiring Regulations).

Ensure that equipment that requires on-line adjustment and testing by non-electrically qualified personnel is accessible and usable without interrupting the supply or overriding safety interlocks. Ensure that in general, field controllers are not located within control panels where isolation is necessary to gain access.

Design panels to maintain all components within their environmental tolerance limits taking into account ambient environmental conditions. Install fans with thermostatic control and air extract grilles and air intake grilles with replaceable filters where mechanical ventilation is required to control the environmental conditions. Ensure that the specified ingress protection (IP) ratings are maintained.

Service conditions

Ambient air temperature to relevant parts of BS EN 61439.
Suitable for ambient air temperature for outdoor installations where required.
Altitude to relevant parts of BS EN 61439.
Suitable for use at altitudes above 1000m where required.
Electromagnetic compatibility
Environment A to BS EN 61439-1 (industrial)
Environment B to BS EN 61439-1 (domestic and light industrial)

Control panel construction

Construct control panels inside buildings to IP54 and IP 55 in wet plant rooms. For external applications, construct enclosures to IP65 unless scheduled otherwise.

Where the enclosure is fitted inside another panel (eg a motor control centre to IP 54 or 55) the protection can be reduced to IP41.

Construct the panels using sheet steel, folded and seam welded to form a rigid self-supporting structure. Ensure that bracing and stiffening is used as necessary to take the weight of internal components and control assemblies. Ensure that no sharp corners are present.

Ensure that control panels weighing more than 50 kg including installed components are fitted with eyebolts to facilitate delivery and installation.

Ensure that panels are provided with adequate undrilled and/or detachable gland plates of sufficient size and strength to accept glands for all types of cable conduits and cable trunking intended for termination within the panel.

Arrange all wiring within the panel in looms and/or perforated trunking. Ensure that all cables are run continuously from terminal to terminal without intervening joints.

Ensure that all terminations are fully shrouded, recessed or otherwise protected against accidental contact to at least IP 2x / IP xxD

Ensure that where live equipment cannot be isolated it is covered with a perspex shield carrying appropriate warning labels in addition to specified shrouding.

Ensure sufficient spare capacity in cable ways and trunking to comply with BS 7671.

Ensure that flexible looms are used to connect door mounted to interior-mounted components such that wires will not weaken or break with repeated door openings. Arrange the loom to avoid pinching or looping when the door is closed and ensure that it is fully supported at each end.

Locks to be multipoint locking system with T-handle / key unless scheduled or described otherwise in the scope of works.

Internal wiring

Standard
BS 6231 polyvinyl chloride (PVC) insulated or BS EN 50625-3-41 low smoke zero halogen (LSZH)
BS 6701, BS EN 50173-series and BS EN 50174-series for telecommunications cables
Identification of conductors - Comply with the following standards, as relevant:
BS EN 60445 core standard for identification of conductors
BS 7671 for wiring forming part of the electrical installation
BS EN 60204-1 for control panels that are classed as a component of machinery in accordance with Supply of Machinery (Safety) Regulations 2008

BS EN 61439-series for switchgear and controlgear assemblies
BS 6701, BS EN 50173-series and BS EN 50174-series for telecommunications cables
Identification of earthing and bonding conductors
Ensure protective conductors are coloured cream and labelled in accordance with and BS 7671 and BS EN 60445.
Ensure dedicated telecommunication functional earth conductors are identified and labelled in accordance with BS 6701.
Ensure combined protective earthing and functional earthing conductors are identified primarily as protective conductors.

Control wiring

Segregate control and auxiliary contact wiring from power circuits and data communications circuits.
Provide electrical separation for voltages of different bands in accordance with BS 7671, BS EN 60204-1 and BS EN 61439- series as relevant.
Contain control wiring in slotted plastic trunking

Take account of thermal effects of grouping when routing power wiring.

Wire termination practice

Identify every wire at each end with a unique wire number according to the control panel drawings and cable schedule. Wire numbers may be formed from numbers and uppercase letters. Ensure the system used cannot be confused with alphanumeric conductor function identification requirements of BS EN 60445 and BS 7671.
Terminate wiring intended for screw terminals with ferrules to prevent damage to conductors, and facilitate fault finding and maintenance replacement of components.

Arrange all wiring within the panel in looms and/or perforated trunking. Ensure that all cables are run continuously from terminal to terminal without intervening joints.
Ensure sufficient spare capacity in cable ways and trunking to comply with BS 7671 (IET Wiring Regulations).
Ensure that flexible looms are used to connect door mounted to interior-mounted components such that wires will not weaken or break with repeated door openings. Arrange the loom to avoid pinching or looping when the door is closed and ensure that it is fully supported at each end.

Provide DIN-rail mounting for equipment and terminate to.

BS EN 60715 dimensional type designation as agreed by the designer:

Ensure steel DIN-rails are manufactured and finished in accordance with Appendix A to BS EN 60715.

Location

Do not locate outstations within control panel compartments where isolation is necessary to gain access.

Control panel labelling

Ensure that all panels and individual panel sections are provided with exterior labels to BS EN ISO 7010 and BS 7671 (IET Wiring Regulations) indicating the voltage within the panel along with clear warnings of risk and instructions for isolation. Display requirements for informing the BMS supervisor and/or disabling alarms prior to isolation of control circuits.
Label all switches, controls and indicators on control panels as to function and associated plant.
Fix a notice to the front of the panel warning of the need for isolation elsewhere if the panel does not totally control the electricity supply to associated plant.
Identify all cables with permanently fixed alphanumeric labelling system. Ensure that the numbering corresponds to the numbers fixed to the terminals. Ensure that identification and coding matches that used on the design drawings, schematics and schedules.

Lights

Use LEDs
Use lens colours in accordance with BS EN 60073.

Audible alarms

Ensure that operation of any starter trip lamp, safety circuit lamp or alarm lamp operates a common audible alarm with mute and test facilities and terminals for remote alarm signal.
When an alarm condition has had the audible alarm muted, ensure that terminals for a remote 'alarm accepted' light are energized. The audible alarm circuit and terminals for remote alarm signal must still be capable of indicating another fault occurring even though original fault has not been cleared. The test facilities are to test momentarily both the audible alarm and alarm indicator lamps, whilst the push button is depressed.
Use alarms that interface with a sensor or controller to sense set-point and measured value. Provide adjustable upper and lower limits on face of unit. Provide unit with indicating lamps to show which limit has been exceeded. Provide each unit with connections for remote alarm.

Surge and transient suppression

Ensure surge arrestors are fitted for star-connected and star-delta started motors to limit peak voltage to 1200 V.

Ensure transient suppressors in the form of resistor and capacitor networks are fitted across starter contactor coils.

Controlgear

Terminals for external conductors

For main power circuits, accommodate cross-sectional area of copper cables in accordance with BS EN 61439-1, Appendix A.

Size neutrals on 3-phase supplies to take account of harmonic content (triple-n's) where relevant, with a minimum of the full current-capacity of the corresponding phase conductors.

For control and auxiliary circuits, provide terminal blocks suitable for DIN rail mounting on top-hat rails dimensional type TH 37-7,5 to BS EN 60715.

Accessibility for inspection

Arrange for following operations to be performed when assembly is in service and under voltage.

Visual inspection of switching devices and other apparatus, settings and indicators of relays and releases, conductor connections and markings.

Adjusting and re-setting of relays, releases and electronic devices.

Replacement of fuse links and indicating lamps.

Fault location by voltage and current measuring.

Accessibility for maintenance

Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.

Use barrier protected sub-sections for each functional unit or group.

Use compartments for each functional unit or group.

Removable parts and withdrawable parts

Degree of protection of assembly after removal or withdrawable of part as manufacturer's standard.

Mounting – As scheduled or detailed in the scope of works

Site modification

Do not make site alterations unless authorised. Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions. Ensure that modifications made comply with type test certificate obtained for arrangement of components.

Provide document pocket inside the control panel, complete with full control panel schematic and wiring schedule.

320.102 FIREMAN'S OVERIDE FAN CONTROL PANEL

Supply and install a fireman's override fan control panel as specified in the scope of works or as indicated on the drawings.

Provide plant switches required are located under a breakglass panel which has a budget lock (ie one which accepts the keyed base of a firemans axe).

Switches shall be configured by plant as Override On/Normal/Override Off. An indicator lamp shall be provided for each position. The colour of the panel shall be agreed with the CA. Allow for stainless steel panel with all text etched and coloured. Panel to be recessed. Size / finish to match fire alarm panel as Architect's details.

320.110 SENSORS - GENERAL:

Ensure that sensors can be removed for testing and maintenance.

Ensure that a tight-sealing test hole is provided adjacent to every duct sensor. Ensure that Binder test points, or similar, are provided for pipe sensors.

Provide a sufficient length of spare cable so that the sensor can be removed without disconnecting the wiring.

Mark and record the location of concealed sensors (e.g. in false ceilings and shafts, etc).

Provide a labelling plate for each sensor.

Take account of the active and inactive sections of a sensor probe.

Take into account the effects of orientation on the functioning of the sensor.

Take into account:

Minimum/maximum ambient temperature.

Ambient humidity.

Vulnerability to spray water and/or vibration.
Explosion protection.
External influences.

320.120 TEMPERATURE SENSORS:

Pipe-mounted immersion sensors

Ensure that the full active length of the sensor is immersed in water.
Install sensors against the direction of flow.
Install at the correct angle.
The sensor should be installed diagonally in a bypass pipe or in a bend if the active length of the sensor probe is longer than the diameter of the pipe.
Allow an adequate space between the sensor and the obstruction so that the sensor can be removed from the immersion pocket.
Ensure that immersion pockets are made from stainless steel of the appropriate pressure rating.
Ensure that immersion pockets are filled with a heat conducting compound.
A test point or an additional immersion pocket, adjacent to the sensor, should be provided for test purposes.
An adequate distance (10 x pipe OD) between the mixing point and the sensor should be provided when mixing water at different temperatures to take account of stratification.

Surface temperature sensor - water

Ensure a smooth clean contact surface and fill the space between the sensor and the pipe with a heat conductive compound to improve thermal conductivity.

Immersion sensors for air (ducts)

The full active portion of the sensor probe should be exposed to the air flow.
Ensure that the active portion of the probe is located central to the airflow.
A test hole should be provided adjacent to every sensor with plug when not in use.
Probe-type sensors should not be used in areas where stratification can occur, eg downstream of heating and cooling coils, etc (see averaging sensors).
Sensors which are positioned near to coils should be shielded against the radiative heat transfer.
Return air duct sensors should be located near to the occupied space to avoid heat gain or loss and radiant effects influencing readings.
Sensors must be positioned in an area of representative air flow. This applies to all duct sensors but particularly the return air sensor which may be located in the ceiling plenum.
The likely cleanliness of the air should be considered when selecting sensors.
Sensors representing zone temperature should be offset to account for heat gains e.g. space temperature stratification or if light fixtures are used as the return air path.
Sensors should only be used in return air ducts where air is continuously extracted.

Capillary sensors with probes

The device head must be higher than the sensor probe.
The sensor probe should be tilted downwards.
The ambient temperature at the device head must always be higher than the temperature to which the sensor probe is exposed.
The sensor element must always point downwards. The capillary should not form a U-shape.
The capillary should not be bent too tightly (radius of bend 50mm).

Averaging sensor (for use in ducts/AHU)

Allow a distance of at least 50 mm between any heat exchanger and the sensor.
The entire length of an averaging sensor must be fully inside the air-duct.
The sensor element must be evenly distributed over the full cross-section and adequately secured to prevent vibration.
The sensor element should be installed in the air flow, downstream of the eliminator plate when air washers are used for humidification.

Frost protection thermostat

Leave a spare capillary loop of 20 cm to enable sensor testing outside the duct/unit.
The measuring head and the test loop of the thermostat must be located inside the ductwork and downstream of the heat exchanger if the ductwork is outdoors or in an unheated space.
The capillary should be installed in the air flow, downstream of the first heating coil exposed to frost.

The capillary must be installed diagonal to the heat exchanger pipes or in a serpentine manner at right angles to the pipes.

Room sensor

Sensors should be installed at a height of 1.5 m in occupied spaces and at least 50 cm from any adjacent walls.

Where room sensors have an adjustable dial they shall be mounted at 1.2m

The sensor should be located in an area representative of the entire control zone.

The sensor should be located away from heat sources, e.g. office IT equipment.

The sensor should be located in the area it controls.

Sensor locations near air currents generated by diffusers or openable windows, for example, should be avoided.

The sensor must not be exposed to direct solar radiation.

Avoid external walls except were unavoidable. Use insulated backplates.

Avoid recesses and alcoves.

The conduit entry points to the sensor wall box should be sealed where there is a risk of air from another zone flowing over the sensor element.

Do not install near or under lamps or above radiators.

Avoid chimney walls.

Do not install directly adjacent to doors.

Do not install behind curtains.

Do not fit to walls concealing hot-water pipes.

Outdoor air temperature sensors

Do not install on facades affected by significant rising heat, or facades which will be heated by solar radiation (fix sensors to a north-facing wall or use solar shields).

Avoid chimney walls and other walls subject to high internal heat gains.

Do not install under eaves.

Do not install above windows.

Do not install above ventilation extracts.

Ensure accessibility for inspection/verification

An alternative to an external mounting is to locate the sensor in the AHU intake duct. This should ideally be upstream of the intake damper and on AHU plant which run continuously (24/7). Where this is not possible it must be a suitable distance before re-circulated air and mechanical devices to avoid their effects.

320.130 HUMIDITY SENSORS:

Humidity sensor/stat. - duct

The air velocity in the vicinity of the sensor must not exceed 10 m/s (a perforated steel plate cover can be used).

The sensor must not be located in deadlegs (super-saturation can occur in areas where there is no air flow).

A test hole must be provided downstream of the sensor, plugged off when not in use.

The sensor should be positioned beyond the spray distance of humidifiers.

Humidity sensor/stat. - room

The sensor should be installed at a height of approximately 1.5 m in the occupied space and at least 50 cm from the adjacent wall.

Avoid locations where the sensor will be exposed to direct solar radiation.

Avoid external walls except were unavoidable. Use insulated backplates.

Avoid alcoves and recesses.

Do not install near lamps or above radiators.

Do not fit to chimney walls.

Do not fit directly adjacent to doors.

320.140 PRESSURE SENSORS:

Pressure - general

Pressure sensors are affected by orientation.

The pressure tubes must be provided with a binder point near the device head for test purposes.

The connection must be fitted with a bypass with a stop valve to avoid overload on one side when manipulating the sensors and to enable zero calibration. Isolating valves should also be fitted.

The sensor should be installed on a vibration-free surface or vibration-proof base.

The pressure-tapping point must not be located in turbulent air flow. Provide 6 x OD upstream and 6 x OD downstream of straight duct or pipe without obstructions.

Pressure - air

Probes for measuring static pressure should be installed parallel to the flow.

The differential pressure measuring tube should be correctly sized.

The tapping point should not be located where it will be affected by obstructions to the flow.

Pressure - liquids

Use a damping coil to avoid transferring vibrations (horizontal loops to avoid trapped air bubbles and condensate).

The device must always be installed in a location which is lower than the sensing point.

Do not measure at the top of a pipe (trapped air, bubbles) or at the bottom (dirt).

Pressure - gases

When measuring vapour gases the device must always be installed in a location which is higher than the sensing point.

Measure at the top of the pipe to prevent condensate from entering the pressure tube.

320.150 FLOW VELOCITY/FLOW RATE SENSORS:

Differential pressure for flow monitoring - liquids

There should be no stop valves or balancing valves between the sensing points on the pipework.

Differential pressure for flow monitoring - air

Ensure a steadying zone upstream and downstream of the orifice plate/flow grid, etc.

The flow or differential pressure must not be monitored where there is a variable resistance such as a filter or fan, etc.

Velocity sensors

Sensors should be positioned at an adequate distance from bends, tees, fans and coils such that the centre line velocity is representative of the average velocity.

A single point sensor should be located at a distance from the centre of the duct equal to 0.25 x the duct radius.

Wilson flow grid

Averaging velocity sensors across the duct, e.g. Wilson flow grid or multi-point averaging pitot tubes, should be used where the minimum separation distance from a flow disruption is not available. Ensure that the Wilson flow grid is sized correctly for each duct size.

320.160 INDOOR AIR QUALITY SENSORS:

CO_2 and mixed-gas sensors - room mounted

Ensure that the sensor is located in a representative location, e.g. on an open wall 1.5 to 3 m above the floor.

Ensure that the sensor is not mounted in niches or bookshelves or behind curtains.

Ensure that the sensor is not located where people are continuously present (within 1 or 2 metres).

CO_2 and mixed-gas sensors - duct mounted

Ensure that the sensor is located in the return air duct as close as possible to the room extract point(s).

Ensure that the sensor is located in the vertical position.

Ensure the correct orientation of the duct probe with respect to the airflow.

Ensure that the sensor is not installed in a vertical position with the head at the bottom.

320.170 ACTUATORS:

Securely mount actuators to rigid members, free from vibration or distortion in accordance with manufacturer's recommendations. Select mounting positions to require minimum linkages, and to avoid angular drive to operating levers. Allow access for servicing and replacement.

Ensure that actuators and linkages for valves and dampers operate smoothly from fully open to fully closed without binding and with adequate torque to overcome the resistance of the actuator mechanism and the flow and to provide the specified close off ratings.

Ensure that linkages are clearly marked with the clamping position such that after maintenance or replacement the mechanism is able to operate correctly.
Fit actuators with visual position indication.
Actuators shall have tamperproof reversible clockwise and anti-clockwise mode selection.
Ensure that there is sufficient space above the actuator so that it may be removed for testing or maintenance.
Include position feedback devices suitable for connection to the BMS.
Ensure that actuators incorporate a disconnection device to allow manual operation of the valve or damper in the event of actuator failure.
Ensure that actuators are electrically and mechanically protected from the effects of valve or damper seizure.
Use 24v actuators wherever possible. Where line voltage actuators are used, provide local means of isolation by manual isolator or plug and socket connection.
Ensure that, during commissioning, valve actuators are fitted in a fully closed/bypass position where they are being fitted to valves which push against a spring.

320.180 VALVES:

General

Ensure that valves have the correct authority without excessive pressure drop.
Ensure that valve bodies are suitable for the medium, the temperature and the pressure of the fluid system.
Ensure control valves have a close-off pressure rating higher than the circuit pressure design.
Ensure that valves will pass the required flow at a pressure drop within the maximum differential pressure rating of the valve.
Check for out-of-balance forces, particularly during operation of a three-port valve.
Where possible ensure that valves are not installed with their spindles in the horizontal position. If valves cannot be installed with their spindles in the vertical position ensure that they are as near as possible to the vertical.
Ensure that valves are not installed with the actuator at the bottom.

Modulating valves

The following additional considerations apply for modulating valves:
Ensure system operating pressures, test pressures, pump heads and pressure drops through heat exchangers and associated pipework are known before control valves are selected.
Select 3 port valves to provide a minimum authority of 0.5 for diverting applications and 0.3 for mixing applications.
Select 2 port valves to provide a minimum authority of 0.3
Select valves with port characteristics appropriate for the intended function.
Ensure that all modulating control valves are selected for equal percentage or linear characteristics according to system type, to provide near linear characteristics between the valve position and heating/cooling power as delivered to the air or water-based system.
Ensure that the rangeability of the selected valves is large enough to provide stable control under low load conditions.

Combined pressure independent 2 port control valves (PICV)

Select, install and commission valves to provide the functions of flow limitation, modulating control and differential pressure control within a single valve body.
The valve manufacturer shall provide test results for each type and size of PICV to be used on the project in accordance with BSRIA Test Method for Pressure Independent Control Valves BTS 1/2012.
Limiting minimum operating pressure – 20Kpa.
For PICVs with a k_v value less than 0.4, a flushing drain should be incorporated in the pipework between the terminal unit and the PICV.
All PICVs' shall have an equal percentage control characteristic, be sized such that the design flow is within the setting range of the valve and be capable of closing against a maximum differential pressure that is greater than the pump head.
Type – Full stroke where the control and flow setting functions are separated within the valve and the full stroke of the valve is available for control (unless scheduled otherwise)
Valve characteristic/control - Equal percentage modulating (unless scheduled or described otherwise elsewhere in this specification).
Duties - To suit terminal unit design flow rates as detailed in equipment schedules.
Standard
Relevant parts of BS EN 60534

Valve leakage class to BS EN 60534-4 when shut off - IV.
Materials:
Body - DZR brass.
Globe or ball - brass.
Stem - brass.
O-Ring/diagram - EPDM rubber.
Springs - stainless steel.
Features - Facility to measure pressure drop across valves at commissioning.
Actuator - 0-10V proportional electric for modulating control or 3 point floating control.

320.190 VALVE SIZING REQUIREMENTS:

All types of valves and applications
Parameter - Body pressure rating.
Requirements - To exceed system test pressure.
All 2-port valves
Parameter - Close-off pressure rating.
Requirements - To exceed pump or system full differential pressure.
All 3-port valves
Parameters - Close-off pressure rating.
Requirements - To exceed out of balance pressures
All types of valves and applications
Parameters - Maximum leakage coefficient.
Requirements - 0.05% kv.
2-port isolation valves
Parameters - Pressure drop at full flow.
Requirements - Select at line size for minimal pressure drop.
2-port modulating valves
Parameters - Pressure drop at full flow.
Requirements - Select kv value for a minimum authority of 0.3, not to exceed 50 kPa.
3-port modulating valves
Parameters - Pressure drop at full flow.
Requirements - Select kv value for 30% - 50% authority against coil or circuit pressure drop.
Isolation valve
Parameter - Characteristic.
Modulating valves (plant valves and zone reheater coil valves)
Parameters - Characteristic.
Requirements - Equal percentage.
Modulating valve (fan coil units)
Parameters - Characteristic.
Requirements - Equal percentage (preferred) or linear.
Modulating valves (independently pumped mixing and injection circuits)
Parameter - Characteristic.
Requirements - Linear.
PICV's – refer to clause 320.180.

320.200 DAMPERS:

Provide visual position indicators on all damper actuators installed so that they can be seen from the plantroom floor.
Ensure that damper characteristics are as linear as possible.
Ensure that modulating dampers are sized correctly to give adequate authority.

320.210 COMMUNICATION NETWORKS - GENERAL:

Ensure that all addressable control devices can be addressed over the communications network.
Ensure that the bandwidth and subsequent speed of communications is sufficient to meet the requirements of the selected manufacturer's BMS equipment.
Ensure that no cross corruption of data occurs when the BMS shares a communication network with other IT-

based systems. Ensure that permission has been given by the IT manager to connect BMS components onto the IT network. Comply with the organisation's IT strategy for connection of devices to the IT data network, including allocation of IP addresses.
Ensure that network testing, identification and documentation comply with BS EN 50173-services and BS EN 50174-series.
Ensure that all network devices such as routers and bridges are compatible with the network and are capable of operating such that the required throughput of data is achieved.
Install communication networks in accordance with BS EN 61918.
Assess the network performance for business-critical functions in accordance with BS EN 61907.

320.220 COMMUNICATION NETWORKS - STRUCTURED CABLING:
Where specified in the scope of works, schedules and controls drawings comply with the following requirements:
Ensure that the selected BMS components are suitable for operating on the structured cabling system.
Ensure that the selected BMS topology (star wired, chained or bus-based) is appropriate for the structured cabling system.
Ensure that each addressable BMS device can be addressed over the structured cabling system.
Where BMS components are specified to be powered from the structured cabling system ensure that the power available is sufficient. Ensure that overheating of the structured cabling system will not occur.
Ensure that any changes to the structured cabling system are reflected in updated documentation.

320.230 COMMUNICATION NETWORKS - INTRANET AND INTERNET APPLICATIONS:
Where specified in the scope of works, schedules and controls drawings comply with the following requirements:
Ensure that the BMS is compatible with relevant security techniques in accordance with BS ISO/IEC 27032
Ensure that the BMS devices to be directly connected onto the Intranet/Internet are TCP/IP compatible.

320.240 COMMUNICATION NETWORKS - MAINS-BOURNE SIGNALLING:
Comply with the requirements of BS EN 50065-1.
Provide the necessary equipment to ensure that there is no mutual interference between the signaling system of the electricity utility and mains-borne signaling of the BMS.

320.250 COMMUNICATION NETWORKS - RADIO COMMUNICATIONS:
Where specified in the scope of works, schedules and controls drawings comply with the following requirements:
Ensure that the radio transmitter/receiver and the BMS components are adequately powered.
Ensure that radio communications devices and associated BMS components are easily accessible to allow the change of batteries.
Ensure that the attenuation of radio signals does not hinder effective data communications.

320.260 INTEGRATION WITH FIRE DETECTION SYSTEMS - GENERAL:
Where specified in the scope of works, schedules and controls drawings comply with the following requirements:
Ensure approval from the relevant Fire Prevention Officer or Building Control Officer.
Ensure that the requirements of BS 5839-1 are not compromised.
Ensure that the fire detection system can operate autonomously and will not be affected by any failure of the BMS.
Ensure that the BMS will not be affected by any failure of the fire detection system or fails safe as appropriate.
Ensure that the loss of electrical power to the BMS will have no adverse effects on the fire detection system.
Ensure that a full cause and effect testing programme is developed in conjunction with the fire alarm company.
Ensure that the integrated system is fully commissioned.
Ensure that the contractual responsibilities of the various parties responsible for the integrated system are fully defined.

320.270 INTEGRATION WITH FIRE SYSTEMS - INTEGRATION DETECTION FOR MONITORING:
Where specified in the scope of works, schedules and controls drawings comply with the following

requirements:
Uni-directional systems
Provide the display of fire alarm detector status information on the BMS operator client indicating the location of fire detector heads or zones, along with their respective status
Ensure that a fire alarm condition automatically displays the appropriate building graphic/schematic along with relevant detector head status or zone status.

320.280 INTEGRATION WITH FIRE DETECTION SYSTEMS - INTEGRATION FOR CONTROLS:
Where specified in the scope of works, schedules and controls drawings comply with the following requirements:
Provide fail-safe, hard-wired interlocks using volt-free contacts between the BMS field controllers and items of plant listed in schedules.
Use volt-free contacts and AC or DC 24V interlocks.
Use relay logic and/or microprocessor-based logic.
Ensure that building services control actions operate correctly in response to the status of the fire detection system.

320.290 INTEGRATION WITH SECURITY DETECTION SYSTEMS - INTRUDER ALARM SYSTEMS:
Where specified in the scope of works, schedules and controls drawings comply with the following requirements:
Provide the display of security sensor/detector or zone status information on the BMS operator client.
Provide any building graphics/schematics on the BMS operator workstation indicating the location of security sensors/detectors or zones along with their respective status.
Ensure that a security alarm condition can automatically display an appropriate building graphic/schematic along with the relevant sensor/detector status.
Ensure that any time delay in receiving security alarm data at the operator workstation client does not exceed the manufacturer's recommendations.

320.300 INTEGRATION WITH SECURITY DETECTION SYSTEMS - ACCESS CONTROL SYSTEMS:
Where specified in the scope of works, schedules and controls drawings comply with the following requirements:
Provide the display of access control status on the BMS operator client.
Provide on the BMS operator workstation building graphics/schematics indicating the location of access control devices along with their respective status.
Ensure that an alarm condition or an access control system can automatically display the appropriate building graphic/schematic along with the relevant sensor/detector status.
Ensure that no configuration of access cards is possible via the BMS.
Ensure that building services control actions operate correctly in response to the status of the access control system.

320.310 INTEGRATION WITH LIGHTING CONTROL SYSTEMS:
Where specified in the scope of works, schedules and controls drawings comply with the following requirements:
Ensure that the following functionality is provided:
Switching of lighting zones in accordance with zone occupation times as set on the BMS.
Switching of lighting zones in accordance with occupancy sensing and light level sensing where this is provided by the BMS.
Monitoring of lighting zones.
Monitoring of lamp run hours.
Raising of an alarm on lamp run hours exceeding the specified maximum.
The ability to override zones.
Ensure that re-definition of zones cannot be performed via the BMS.
Direct interoperability – Ensure that the requirements of clause 310.470 are met.
Gateway link - Ensure that the requirements of clause 310.480 are met.

330.330 CONTROLS CIRCUITS:
Supply Voltage - Ensure control circuits are DC (negative-earth) or AC 230 V sourced from common single-phase supply. Control circuits from single-phase supplies derived from different phases shall not be used in the same enclosure.

330.340 CONTROL CIRCUITS TRANSFORMERS:
Provide control circuit transformers to supply power at voltages to suit control components.
Standards
Use transformers in accordance with BS EN IEC 61558-1 and either BS EN 61558-2-2 or BS EN 61558-2-6, and provide an external label of approved type and size.
Protection - Primary and secondary fuses

340.000 WORKMANSHIP:

340.010 GENERAL:
Install pipeline control components in accordance with manufacturer's instructions.
Install ductline control components in accordance with DW/144 and manufacturer's instructions.
Install control components in accordance with manufacturer's recommendations, in positions indicated.

340.020 APPEARANCE:
Arrange, support and clip all control wiring, pneumatic tubes and capillaries to present a neat appearance, with other services and the building structure.

340.030 INSULATION:
Where control components are incorporated in insulated pipelines, ductlines or equipment, provide details for approval of method proposed to insulate component.

340.040 SUPPORTS:
Arrange supports for control components to ensure no strain is imposed on components.

340.050 ACCESS:
Arrange control components to ensure adequate access for operation and maintenance.
Comply as relevant with BS EN 547-series and BS 7671 (IET Wiring Regulations) requirements for maintenance gangways.

340.080 POWER OPERATED CONTROLS:
Install power operated controls in accordance with manufacturer's instructions and relevant standards.

340.090 ELECTRIC MOTOR ACTUATORS:
Securely mount actuators to rigid members, free from vibration or distortion in accordance with manufacturer's recommendations. Select mounting positions to require minimum linkages, and to avoid angular drive to operating levers. Allow access for servicing and replacement.

340.100 SENSORS/CONTROLLERS:
Install sensors/controllers in accordance with manufacturer's instructions, in accessible locations. Install wall mounted components, where indicated.

340.105 TEMPERATURE SENSOR LOCATION:
Internal

Install temperature sensors: out of sources of draughts; away from doors and sources of heat or cooling; away from sources of water / sinks; out of the reach of direct sunlight; not in partitioned offices; approximately 1500 mm above floor; in a position which will not be covered.
They should also be coordinated with the Architect’s furniture drawings to ensure they are not blocked or covered.
The Contractor shall ensure that the conduit to the back of the sensor is completely sealed.

External

Out of the reach of direct sunlight; away from any heat sources, exhaust, open windows; in a safe, tamperproof location.

340.110 ANCILLARIES:
Install ancillaries in accordance with manufacturer's instructions.

340.120 ENCLOSURES:
Install enclosures where indicated, providing space for access and maintenance.

340.121 PACKAGED PLANT:
Make all digital and analogue control interfaces between the BMS and packaged plant as detailed on the Controls diagrams and individual plant schedules and elsewhere in the specification.
Make connections to packaged plant within the plant control panel. Where insufficient space within such panels fit a further enclosure to the plant to accommodate the connections.

340.122 PANELS, WIRING AND WIRE WAYS:
Install all Panels, wiring and wire ways as described in the appropriate reference specifications.
Other than in individual starters and the interlocks from local isolators, the control circuit voltage shall not exceed 110 Volts ac (55-0-55). Where control circuits are taken outside the enclosure to remote equipment use 24 Volts maximum.
Where modifying existing installations, agree the detail of the above with the S.O.

340.130 BUILDING MANAGEMENT SYSTEM INSTALLATION:
Install commission and set to work building management system in accordance with the manufacturer's recommendations.

340.140 BUILDING MANAGEMENT SYSTEM CABLE INSTALLATION:
Plan and install all building management monitoring systems cables in accordance with the cable manufacturer's recommendations.
Label and record all monitoring cables

340.150 BUILDING MANAGEMENT SYSTEM QUALITY CONTROL:
Handle, store and install equipment and components of the building management system in accordance with the manufacturer's recommendations.
Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.
Record all commissioning tests and site modifications to hardware or software, and revise operating and maintenance instructions accordingly.
Inspect installed and operational functions of Building Automation, Controls and Technical Building Management System including its configuration in accordance with BS EN 16946-1.
Manage configuration of software, settings, data and design, in accordance with an appropriate Configuration Management Plan complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC 12207 and BS ISO/IEC/IEEE 15288.
Provide configuration details along with the operation and maintenance manual on handover.
Manage information security systems, software and data during design, implementation and commissioning in line with BS EN ISO/IEC 27001.

340.160 CONTROL SYSTEM FUNCTION CHARTS:
Prepare function charts for the control system in accordance with BS EN 60848. Obtain approval for function chart before design of system hardware or writing control software.

350.000 COMMISSIONING:
Commission in accordance with CIBSE Commissioning Code C. Refer to section Y51 for BMS commissioning and seasonal commissioning requirements.

Undertake and manage integrated commissioning in accordance with CIBSE Commissioning Code M: Commissioning Management

Perform interface testing with all other logically-connected systems

Perform whole building integrated testing as scheduled or described in the scope of works.

Perform black building integrated testing as scheduled or described in the scope of works.

The BMS / controls specialist shall assist with seasonal commissioning during four separate occasions with three monthly intervals during the defects liability period in the first year after handover unless scheduled or detailed otherwise elsewhere in this specification.

360.001 DEMONSTRATION AND HANDOVER:

Refer to General scope of works for project particular requirements and section Y51 and “A” sections of the specification for standard clauses for BMS witnessing requirements, operator training and post-handover checks.

Refer to work section A37 or A64 or A64D for requirements for BMS O&M manual.

360.040 SOFTWARE:

Ensure that a copy of the configuration software is securely held both on and off-site.

Ensure that, as alterations are made to the configuration software, all previous versions of the software are securely archived.

Ensure that all credentials are transitioned to the operation and maintenance organisation(s) at handover.

10000 Ref NES Text Dec 19

W70 – Structured Cabling System

PART 1SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES

Engage a specialist to carry out all works described within this work section.
Provide a structured cabling system (SCS) compliant with all clauses contained within this work section.
Provide and incorporate all necessary equipment, accessories and ancillaries for a complete working structured cabling system. If there are any areas of doubt, or if any other equipment or ancillary works are required to provide a complete working system, it is the responsibility of the contractor to identify the works, equipment and components required and to provide the necessary items.
All works described within this work section shall be carried out by a specialist structured cabling contractor.

100.020 DESIGN PARAMETERS

Design and install the structured cabling system in compliance with standards requirements and recommendations of the system supplier.
Ensure the detail design, selection of products and implementation of the telecommunications. equipment and telecommunications cabling is in accordance with the guidance and recommendations within BS 8492 - Code of practice for fire performance and protection which supports the requirements of BS 6701.

100.030 SYSTEM DESCRIPTION –

Supply, install and test a structured cabling system.
Type
339. Screened.
340. Unscreened.
341. Standard
- BS EN 50173-1
- BS EN 50173-2
- BS EN 50173-3
- BS EN 50173-4
- BS EN 50173-5
- BS EN 50173-6

348. Class
349. Class D
350. Class E
351. Class EA
352. Class F
353. Class FA
354. Install and test a structured cabling system in accordance with
355. Standard
- BS EN 50174-1
- BS EN 50174-2
- BS EN 50174-3
- BS EN 50346

360. FIA-TSD-2000-4-2-1Optical Fibre Cabling: Testing of installed cabling: LSPM (Light Source and Power Meter)
361. FIA -TSD-2000-4-2-2 Optical Fibre Cabling: Testing of installed cabling: OTDR (Optical Time Domain Reflectometer)
362. FIA-TSD-2000-4-2-3 Optical Fibre Cabling: Testing of installed cabling: Specification, procurement and use of test cords
- BS EN 61280-4-1
- BS EN 61300-3-35

365. PD IEC/TR 62627-01
366. [.....]
367. Provide the entire copper structured cabling system from a single manufacturer.
368. Provide the entire optical fibre structured cabling system from a single manufacturer.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W70.

300.005 PRECEDENCE AND APPLICATION OF STANDARDS:

National standards precede regional standards, which in turn precede international standards.
This specification is based on UK and European Standards, to achieve an approach for safety and compatibility for electrical, data network and information technology installations, and equipment, aligning with the European Committee for Electrotechnical Standardisation (CENELEC) approach.
Identify any instances where the proposed solution does not conform to the above.

300.010 AMENDMENTS AND REVISIONS:
Comply with any published amendments and revisions to standards, requirements and recommendations issued up to and including start on-site (and subsequently where the contractor can reasonably be assumed to be able to comply).

300.020 STANDARDS CONTRADICTIONS:
Confirm that this document has been checked to identify any areas it appears to contradict any of the standards referenced in this document.

300.030 STANDARDS:
Carry out work in accordance with the following standards and all standards that are referenced within
Standard
- BS EN 50173-1
- BS EN 50173-2
- BS EN 50173-3
- BS EN 50173-4
- BS EN 50173-5
- BS EN 50173-6
- BS EN 50174-1
- BS EN 50174-2
- BS EN 50174-3
- BS 6701
- BS 7671
- BS EN 50346
- BS EN 61280-4-1
- BS EN 61280-4-2
- BS EN 61300-3-35
- PD IEC/TR 62627-01

369. Provide the entire copper structured cabling system from a single manufacturer.
370. Provide the entire optical fibre structured cabling system from a single manufacturer.

300.050 INDUSTRY PRACTICE:
Carry out work in accordance with the following industry practices.
Ensure that the structured cabling system is fully compliant with the fibre optic industry association (FIA) code of practice for the testing and installation of optical fibre cables and assemblies
- FIA-TSD-2000-4-2-1 Optical Fibre Cabling: Testing of installed cabling: LSPM (Light Source and Power Meter
- FIA-TSD-2000-4-2-2 Optical Fibre Cabling: Testing of installed cabling: OTDR (Optical Time Domain Reflectometer)
- FIA-TSD-2000-4-2-3 Optical Fibre Cabling: Testing of installed cabling: Specification, procurement and use of test cords

300.060 MANUFACTURER'S GUIDELINES:
Carry out work in accordance with the manufacturer's requirements, guidelines and recommendations.

300.070 CLIENT SPECIFIC STANDARDS:
Provide the structured cabling system in accordance with:
371. Preferred system [.....]
372. Preferred supplier [.....]

300.080 ELECTROMAGNETIC COMPATIBILITY:
Ensure all cabling is installed considering the requirements of BS 6701, BS 7671, BS EN 50174 series and manufacturer's instructions.
Provide earthing and bonding in line with manufacturer's recommendations, BS 6701, BS 7671 and BS EN 50310

310.000 SCHEDULE OF RESPONSIBILITIES

Carry the work indicated on the following schedule and check the work indicated is to be carried out by the client or other is done in accordance with the programme.
Except if and where marginally varied by the detail later in the specification, the schedule reference below indicates which items are part of the SCS contract and which items are excluded from their contract, and therefore provided by others as noted.

Item	SCS contractor	Client	Developer / Landlord	Fit Out Contractor	Main Contractor
Enabling works					
Containment (External)					
Containment (Internal)					
Back boxes					
Floor boxes					
Faceplates for back boxes					
Faceplates for floor boxes					
Campus Backbone Cabling (Fibre)					
Building Backbone Cabling (Fibre)					
Campus Backbone Cabling (Copper)					
Building Backbone Cabling (Copper)					
Horizontal Cabling (Fibre)					
Horizontal Cabling (Copper)					
Cabinets					
Frames					
Voice adaptors					
Fly leads					
Patch cords (Fibre)					
Patch cords (Copper)					
Installation of fly leads					
Installation of patch cords					
Patching Schedule					
Cable Management System					
Documentation					

310.010 ROOM TERMINOLOGY:

The following room terminology is utilised throughout this work section:

Building Entrance Facility.
373. Accommodation for
374. Termination of external cabling where it enters the building as a contractual interface.
375. Conversion of cables from external to internal fire performance.

Floor Equipment Room.
Accommodation for
Termination point of horizontal cabling subsystem (Floor distributor FD).
Active distribution equipment.

Building Equipment Room.
Accommodation for
Termination point for campus backbone cabling subsystem (Campus distributor CD)

Termination point of building backbone cabling subsystem (Building distributor BD)
Termination point of horizontal cabling subsystem
Active core equipment.
Active distribution equipment.
Server Room.
Accommodation for
Server equipment.
Storage area network equipment.
Backup equipment.

310.020 TERMINOLOGY:

The following terminology is used throughout this section:
Telecommunications Outlet (TO). Fixed connecting device where the horizontal cabling terminates (the telecommunications outlet provides the interface to the work area cabling).
Floor Distributor (FD). Distributor used to make connections between the building backbone cabling subsystem, active equipment and cabling subsystems specified in the following standards
BS EN 50173-1
BS EN 50173-2
BS EN 50173-3
BS EN 50173-4
BS EN 50173-5
BS EN 50173-6
Building Distributor (BD). Distributor in which the building backbone cable(s) terminate(s) and connections to the campus backbone cable(s) may be made.
Campus Distributor (CD). Distributor from which the campus backbone cabling emanates.
Data Patch Panel (DPP). Active data equipment termination point.
Building Entrance Facility (BEF). Facility that provides all necessary mechanical and electrical services, that complies with relevant regulations, for the entry of telecommunications cables into a building and which may allow for transition from external to internal cable.
Link. The transmission path between two specified test interfaces of generic cabling such as the TO (Telecommunications Outlet) and the HD (Horizontal Distributor).
Channel. Any transmission path comprising passive cabling components between application-specific equipment or between an external network interface and application-specific equipment.

320.000 HORIZONTAL CABLING SUBSYSTEM

Link by horizontal cabling all TO's to the FD in a star topology, with each cable terminated, presenting an RJ45 type outlet at the TO end. Terminate at the FD, end the cable onto either an RJ45 patch panel, IDC (Insulation Displacement Connection) type interface such as a 237a strips.
Note, user outlets (RJ45 type outlets) are 4 pair (8 wire) outlets and may serve both/either, voice and data needs functions (i.e. telephones, fax, PCs, terminals, printers, etc.). The jumpering of pairs for 2 wire, 4 wire or 6 wire applications is made in the FD or BD; leaving all horizontal cabling to be tested in the same way.

320.010 HORIZONTAL CABLE:

Cables supplied must conform to the construction and performance requirements for the required category and design of cable being used to support the class of performance required for the cabling system.
Sheath sharing is not recommended unless approved by the cabling system manufacturer.
All 4 pairs in a 4 pair cable must be terminated at both ends of the link.
Use of single manufacturer products is recommended throughout the cabling system.
A manufacturer originated performance warranty and application support statement must be provided for the completed cabling system following installation and testing.
Copper cable type
Sheath composition
The fire performance of the cable sheath must support the requirements of the site fire assessment.
Ensure that the manufacturers bend radius is not exceeded throughout the installation by selecting containment and pathways which protect the cables.
Termination of the cables into connectors must be in accordance with the recommended practices from the cabling system manufacturer.
Ensure each cable and each sheath is continuous throughout its route length with no cable splicing or joints.
Minimum cable for a link length will be specified by each cabling system manufacturer. Consult the cabling system manufacturer and obtain their approval for the combination of cable types and lengths being installed, including any cordage to connect links to equipment.
Notify the relevant parties if works installed by others may mean that it would be difficult or impossible to

meet the bending radii requirements.
Install cables in the relevant containment as shown on the drawings and schedules.

320.020 USER OUTLETS:
Provide user outlets in the quantities and locations necessary to support the user's voice, data and BMS requirements as shown on the drawings and schedules.
Provide an administration and/or labelling scheme where described in the scope of works in accordance with the following standards

- BS EN 50173-1
- BS EN 50173-2
- BS EN 50173-3
- BS EN 50173-4
- BS EN 50173-5
- BS EN 50173-6
- BS EN 50174-1
- BS EN 50174-2
- BS EN 50174-3

Clear, fade resistant labels to be provided on outlet faceplates at both ends of all cables and on the termination panels. Approval must be sought from the cabling system owner/operator for the style, font, size, colour and presentation of labels before deployment.
The location and quantity of the user outlets are detailed in schedule reference W70sch1.
Provide all face-plate outlets to be modular snap fit, such that one can be removed from a face-plate without affecting the others. Note, this applies to face-plates not patch panels.

320.030 EQUIPMENT LOOMS:
The cable style and performance shall match the remainder of the cables system components used throughout the installation.
Locate the active network equipment in the equipment cabinets for the physical security, airflow management and protection, do not use or open frames. Locate the equipment loom patch panels in the floor distributors.
Form the plug end of the looms neatly to plug into the active equipment (or left spare for future connection).
Terminate or present the other end of the equipment loom on the active data RJ45 patch panel (DPP).
Ffor the location and quantity of the equipment looms refer to Schedule reference W70sch2.

320.040 HORIZONTAL CABLE PRESENTATION:
Present the horizontal cable on patch panels within cabinets or frames as defined later in this work section.
Patch panel type
Separate the patch panels by 1U cable tidies such that each cable tidy is followed by not more than 48 outlets, followed by a 1U cable tidy and so on, i.e. one cable tidy per 48 outlets plus one additional cable tidy.

320.060 SCHEMATIC DRAWINGS:
Provide a schematic drawing showing the proposed layout of each of the floor distributors.

330.000 BUILDING BACKBONE CABLING SUBSYSTEM
Provide, install and test the building backbone cabling subsystem.
Type

330.010 FIBRE BACKBONE CABLING:
The optical fibre solution used in this installation must be sourced from a single solution vendor and be supported by warranty for performance and application support using the configurations required by clients operations. Mixing and matching of components from different vendors is not permitted.
Throughout all the client installation the preferred fibre types used are
The connector performance provided must be better than the maximum loss limits for the environment, cabling type and application being supported set out in the following standards.

- BS EN 50173-1
- BS EN 50173-2
- BS EN 50173-3
- BS EN 50173-4
- BS EN 50173-5
- BS EN 50173-6

Type

Note for diverse topologies the core quantity detailed above is per route, i.e. a diverse star topology with 12 cores would be provided as 2 diverse routes each with 12 cores.
Building Distributor end termination
Refer, for details of fibre backbone cabling to particular specification.

330.015 BUILDING BACKBONE - FIBRE PRESENTATION:
376. Terminate and present the fibre backbone cable on patch panels within cabinets or frames as defined later in this work section.
Patch panel type
Start and end each patching area with a 1U cable tidy, with each patch panel separated by 1U cable tidies. Provide the total amount of cable as the total amount of patch panels plus one additional cable tidy.

330.030 COPPER BACKBONE CABLING:
Provide copper backbone cabling from the building distributor to each floor distributor as follows:
Topology
Refer, where more than one type of cable is selected, to the quantities that are detailed in the schedules.
Refer for size and quantity of the copper backbone cabling to particular specification or schedule W70sch3.

330.035 BUILDING BACKBONE - COPPER PRESENTATION:
Terminate and present the copper backbone cable on patch panels within cabinets or frames as defined later in this work section.
Patch panel type
Separate the patch panels by 1U cable tidies such that each cable tidy is followed by not more than 48 outlets, followed by a 1U cable tidy and so on, i.e. one cable tidy per 48 outlets plus one additional cable tidy.

330.050 TELECOMMUNICATIONS TIE CABLE:
Provide telecommunications tie cables as follows:
330.055 TELECOMMUNICATIONS TIE CABLE PRESENTATION:
Terminate the tie cable on panels within cabinets or frames as defined later in this work section.
Separate the patch panels by 1U cable tidies such that each cable tidy is followed by not more than 48 outlets, followed by a 1U cable tidy and so on, i.e. one cable tidy per 48 outlets plus one additional cable tidy.

330.070 SCHEMATIC DRAWINGS:
Provide a schematic drawing showing the proposed topology and connections of the
377. Building fibre backbone
378. Building copper backbone
379. Tie cables

340.000 CAMPUS BACKBONE CABLING SUBSYSTEM:
Provide campus backbone cabling system.
Type
380. Fibre
381. Copper
Refer for size and quantity of the copper backbone cabling to the particular specification.

340.010 FIBRE BACKBONE CABLING:
Provide fibre backbone cabling between the Building Distributors in each building as follows:

340.020 CAMPUS BACKBONE - FIBRE PRESENTATION:
Terminate and present the fibre backbone cable on patch panels within cabinets or frames as defined later in this work section.
Patch panel type
Start and end patching area with a 1U cable tidy, with each patch panel separated by 1U cable tidies. Provide the total amount of cable tidies the total amount of patch panels plus one additional cable tidy.

340.040 COPPER BACKBONE CABLING:
Provide copper backbone cabling between the Building Distributors in each building as follows:
340.050 CAMPUS BACKBONE - COPPER PRESENTATION:
Terminate and present the copper backbone cable on patch panels within cabinets or frames as defined later in this work section.

Separate the patch panels by 1U cable tidies such that each cable tidy is followed by not more than 48 outlets, followed by a 1U cable tidy and so on, i.e. one cable tidy per 48 outlets plus one additional cable tidy.

340.070 SCHEMATIC DRAWINGS:
Provide a schematic drawing showing the proposed topology and connections of the
- Campus fibre backbone
- Campus copper backbone

350.000 PATCH CORDS AND FLY LEADS
Utilise patch cords to patch the required services to the required outlets within both the Floor and Building Distributors.
Note, fly leads are utilised to provide the final connection from the user outlet to the end device.
Type
382. Copper
383. Fibre

350.010 COPPER PATCH CORDS AND FLY LEADS:
Provide copper patch cords and fly leads composed of stranded not solid conductors and be provided with factory fitted RJ45 plugs.
Refer for types, lengths and colours of the copper patch cords to Schedule reference W70sch4

350.020 FIBRE PATCH CORDS:
Provide fibre patch cords.
Refer to, for types, lengths and connections of the fibre patch cords ,Schedule reference W70sch5
All connectors to be factory fitted.
Test certificate with test results supplied.

350.030 PATCH CORD INSTALLATION:
Install the following patch cord type to ensure the correct device is patched to the correct service.
384. Copper
385. Fibre
All optical fibre cords must be inspected with a microscope and if required cleaned before insertion into a patch panel or outlet.
The responsibility for production of the patching schedule is
386. Client

350.040 FLY LEAD INSTALLATION:
Install all fly leads to ensure the correct device is connected to the correct user outlet. The responsibility for production of the patching schedule is
387. Client

360.000 CABINETS AND FRAMES

360.010 CABINETS:
Provide cabinets
388. Colour [.....]
389. Width [.....]
390. Depth [.....]
391. Height [.....]
392. Doors [.....]
393. Ventilation [.....]
394. 19" blanking panels [.....]
395. Multipoint earthing strip [.....]
396. Internal additional earthing / bonding to power distribution strip protective earth and metallic parts of cabinet [.....]
397. Earthing / bonding connection to Common Bonding Network or Mesh-Bonding Network [.....]
Manufacturer and reference [.....]
Or approved equivalent
Standards
BS 7671
BS EN 50310

BS EN 60950-1
BS EN 62368-1
BS EN 60297-3 series
BS EN 60917 series

Provide cabinets to house the building and floor distributors and the following equipment as provided by others:

398. Active data equipment
399. UPS
400. CCTV equipment
401. BMS

Type

402. Free standing
403. Wall mounted
    404. Hinged
    405. Non-hinged

Size and quantity of the cabinets are detailed in schedule reference W70sch6.
Cabinets to be of steel construction throughout
Install cabinets that are immediately adjacent to each other with no side panels, bayed together.
Provide vertical cable containment, installed vertically in the middle of each side.
Provide vertical patch cord guides to manage patching, installed vertically at left and right of the front and similarly at the rear for cabinets with front and rear patching.
Schedule reference W70sch6
Ancillaries

360.020 19" OPEN FRAMES:

Provide 19" open frames

406. Provide 19" open frames to house the building and floors distributors, and the following equipment as provided by others.

Type

407. Floor standing
408. Sub frame
409. Plinth
410. Wall mounted
    411. Hinged
    412. Non-hinged
413. Refer for the size and quantity for each type of open frame to Schedule reference W70sch7.

Install open frames which are immediately adjacent to each other bayed together.

360.030 TELECOMMUNICATIONS SPECIFIC FRAMES:

Use, where the copper backbone(s) and telecommunications tie cable(s) have been specified as being terminated on 237a strips, specialist telecommunications frames to accommodate the 237a strips.
Manufacturer and reference

370.000 INSTALLATION:

Ensure all manufacturer guidelines, main contractor site rules and client requirements detailed within the complete tender documentation are followed.
Carry out all installation works in accordance with the site health and safety file, with the contractor ensuring their areas of responsibility operate in a clean and tidy environment. Ensure all outlets are protected from dust ingress.

370.010 BRING INTO SERVICE SUPPORT:

Make available engineers over at least the 2 days either side of each bring into service (BIS) date, as well as on the BIS date(s) itself, to provide whatever support is required.

370.020 PROJECT MANAGEMENT:

Appoint a qualified and experienced structured cabling system project manager to plan, direct and oversee their works and workers, and to liaise with and provide timely information to all relevant parties.
414. Identify any areas of risk with the main contractor's plan,
415. Meet the main contractor's programme.

370.030 TRAINING:

Train the users how to use the system, showing all elements of patching and user outlet relocation and

addition.
Provide training for up to
With training being scheduled with reasonable notice at the request of client name or their agents. Train the users together or separately, before or within 1 month after hand over, at the discretion of client name or their agents.

370.040 TESTING:
Carry out full testing as specified in the standards for all elements of the structured cabling system, and obtain appropriate passes for each element such as to ensure total structured cabling system compliance with the standards.
Tests to include but not be limited to
- Testing in accordance with the manufacturer's standards and the following BS EN and FIA standards
  - BS EN 50346
  - FIA-TSD-2000-4-2-1 Optical Fibre Cabling: Testing of installed cabling: LSPM (Light Source and Power Meter)
  - FIA-TSD-2000-4-2-2 Optical Fibre Cabling: Testing of installed cabling: OTDR (Optical Time Domain Reflectometer)
  - FIA-TSD-2000-4-2-3 Optical Fibre Cabling: Testing of installed cabling: Specification, procurement and use of test cords
  - BS EN 61280-4-1
  - BS EN 61280-4-2, IEC 61280-4-2
  - BS EN 61300-3-35
  - PD IEC/TR 62627-01

Tests carried out on the voice cabling to include but not be limited to
- Full continuity tests on every conductor.
- Polarity tests on every pair.

Tests carried out on the fibre optic cabling to include but not be limited to Light Source and Power Meter tests.
All test results for copper and optical fibre must be produced by electronic means and submitted in electronic versions along with any tester specific software to review, read and analyse them. All software is to be provided free of charge and license free on CD.
Tests to be carried out on cabinet / rack installations to include inspection and testing required by BS 7671, including but not limited to continuity of earthing / bonding conductors.

370.050 TESTING EQUIPMENT:
List and describe the proposed testing equipment which will be used on-site and/or in their factory.
Provide copies of valid calibration certificates for all equipment used for testing to the client or their agents at their premises with reasonable notice.
Provide sample test result sheets for each of the tests to be carried out.

370.060 INSPECTION CHECKS:
Note, during the installation period the client or their agents will make various physical inspections of the installation, including but not limited to: standard of workmanship, standards adherence, labelling, monitoring of the testing process, review of test results.
Also note, the client or their agents will carry out witness checks of about 10% of the structured cabling system and the testing. Ensure reasonable notice is given before commencement of any tests.
Also note before hand over and after full testing by the contractor, the client or their agents will carry out random sample tests to confirm the quality of the installation. Tests will include electronic tests, inspection of labelling and workmanship.
Make available all personnel and equipment required to enable the client or their agents to carry out any of the above checks, both on-site and/or in their factory.

370.070 AS INSTALLED INFORMATION:
Provide an operations manual that explains how to use the structured cabling system and describes what can and what cannot be connected to it.
Provide the as installed information as defined below and in accordance with the main contract requirements. Provide this information as part of the systems operations manual.
- Drawings
  - Equipment room plan
  - Equipment room elevation
  - Outlet positions
- Schedules

Cables and outlets
Test results
Component descriptions
Handover certificate
Warranty certificate

370.080 LABELLING:

Propose and provide an appropriate identifier schedule and labelling scheme modified by the clients' requirements for scope and colours based on the requirements of the following standards

BS EN 50173-1
BS EN 50173-2
BS EN 50173-3
BS EN 50173-4
BS EN 50173-5
BS EN 50173-6

Provide appropriate labelling for all elements of the scheme, including, where agreed

Horizontal cabling subsystem
Horizontal cable (both ends as a minimum)
User outlet
Patch panel, both the panel and the outlet
Building backbone cabling subsystem
Backbone cable (both ends as a minimum)
Patch panel, both the panel and the outlet
Campus backbone cabling subsystem
Backbone cable (both ends as a minimum)
Patch panel, both the panel and the outlet
Fly leads (both ends as a minimum)
Cabinets and frames

Label cables at all points where they enter or exit from concealment.
Ensure that labels are suitably durable so as to remain functional for the life of the cabling system.
Prove labelling is machine produced. Ensure that hand written labels are not used.
Label patch panel of 2 rows of characters, top row to be common to the complete length of the patch panel and be descriptive of the outlet type, i.e. 1st Floor User Outlets, the bottom row to identify each individual outlet.

370.090 LABELLING SCHEME:

Adopt the proposed labelling scheme identified in clauses 370.092, 370.094 and 370.096.

370.092 HORIZONTAL CABLING SYSTEM:

Uniquely identify each user outlet using the following notation (note, fields are only required where category is included in the scheme):

End A Campus - Building - Floor - Comm's Room - Cabinet or Frame - Vert (patch panel location) - Outlet Floor - Outlet - Cable or Outlet Performance
Uniquely identify each horizontal cable at both ends using consecutive numbers.
Uniquely identify each fly lead at each end to match the user outlet.

370.094 BUILDING BACKBONE CABLING SUBSYSTEM

Uniquely identify each backbone cable at both ends containing an identifier/description for both the source and the destination of the cable. Uniquely identify each pair or outlet within each backbone cable at both ends as a 2 or 3-digit number running sequentially.

End A Campus - Building - Floor - Comms Room - Cabinet or Frame - Vert (patch panel location) - Outlet
End A Campus - Building - Floor - Cooms Room - Cabinet or Frame - Vert (patch panel location) - Outlet - Cable or Outlet performance
Uniquely identify each fly lead at both ends to match the patched locations in the comms room (outlet to outlet or outlet to equipment).

370.096 CAMPUS BACKBONE CABLING SUBSYSTEM

Uniquely identify each backbone cable at both ends containing an identifier/description for both the source and destination of the cable. Uniquely identify each pair or outlet within each backbone cable at both ends as 2 or 3-digit number running sequentially.

End A Campus - Building - Floor - Comms Room - Cabinet or Frame - Vert (patch panel location) - Outlet
End A Campus - Building - Floor - Comms Room - Cabinet/Frame - Vert (patch panel location) - Outlet - Cable or Outlet performance
Uniquely identify each fly lead at both ends to match the patched locations in the comms room (outlet to outlet or outlet to equipment).

380.000 WARRANTY:

Provide a warranty for the complete structured cabling system.
Cover appropriate extensions to the structured cabling system by the warranty. Appropriate extensions to be those which meet the manufacturer's design guides, installed by the contractor (or by any other contractor registered with and authorised by the end manufacturer as a certified installer) using certified components and procedures as prescribed by the manufacturer.
Arrange for the structured cabling manufacturer to visit site during the installation and at practical completion and confirm to the client, or their agents, manufacturer compliance.
Ensure the warranty is not voided by normal use of the system, including moves and changes carried out by the client or their agents.
Ensure the warranty provides for the client or their agents to contact the contractor in the first instance, who shall attend the site within one working day to carry out appropriate tests and who will then progress the claim through the manufacturer. Agree action on the claim and initiate within 10 working days of notification of the claim. Ensure the action shall be completed without unreasonable delay.
416. Arrange a contract between the client and the manufacturer such that if the contractor is no longer in existence (or in the event of non-performance by the contractor) then the manufacturer shall fulfil all the obligations of the contractor.
417. State the name, address and claim contact details (department name, person's name and phone number) of the manufacturer. This may be used to verify that the warranty is fully compliant with the above requirements.

10000 NES Based on VERSION W70 June 18

1010 PRE-FABRICATED PIPEWORK:

Supply pre-fabricated pipework in accordance with relevant materials and workmanship clauses and as detailed in the particular specification / schedules. When using proprietary piping systems / ancillaries, comply with the manufacturers' installation instructions.

1012 PIPEWORK LAYOUT / GENERAL REQUIREMENTS / FIRE STOPPING:

[Partly based on NES 210.010 210.050]

General

Set out pipework as indicated on the installation drawings, making due allowance for any diagrammatic presentation.

The tender drawings show the design intent and do not necessarily show all facilities for filling, flushing, cleaning, draining and chemical cleaning of the water systems.

The Contractor shall include in the installation all necessary facilities, including sample coolers (if required), to enable a Specialist to successfully fill, drain, flush, clean, and chemically treat the systems listed in schedule Y25 in accordance with the latest edition of BSRIA Guide BG29 “Pre-commissioning cleaning of pipework systems”.

The Contractor shall review all designs to ensure that systems are commissionable in accordance with the CIBSE commissioning code W and BSRIA Guide BG2/2010 as detailed in Y51. If additional facilities are required the Contractor shall advise the designer prior to commencing work on site.

All pressure equipment shall be designed, manufactured and certified in accordance with the Pressure Equipment Regulations 1999 and The Approved code of practice (ACOP) L 122 “Safety of Pressure Systems

Provide all necessary offsets, bends, tapers, transformation pieces, anchors and guides etc. required whether or not these are detailed.

Make due allowance for any thermal movement on long runs. Any provisions for expansion, anchors and guides shown on the drawings are for guidance, the actual requirements shall be determined by the Contractor. Also refer to clause Y10.4061 and clauses Y11.2611, 2620, 2631/2631A/2631B, 2651and 2661 for further detail on expansion facilities. The contractor shall utilise one of the named specialists for the provision of expansion facilities and confirm in their tender submission that all provisions for pipework expansion have been included.

Multilayer pipe system for indoor gas installations manufactured and installed as a complete system from a single manufacturer including pipes, fittings, tools etc. in accordance with BS ISO 17484-1 and ISO 17484-2

Multilayer pipe systems for indoor hot and cold water installations and heating systems manufactured and installed as a complete system from a single manufacturer including pipes, fittings, tools, etc. in accordance with relevant parts of BS EN ISO 21003

Plastics piping systems for hot and cold water systems or hot water heating systems within buildings to have a classification appropriate to the application / service conditions and have a design period of 50 years in accordance with BS ISO 10508.

The plastic piping system manufacturer to demonstrate the system has been tested in accordance with BS EN ISO 19893 for the resistance of assemblies of pipes and fittings to temperature cycling.

Fire stopping

Comply with BS 9999, relevant approved technical guidance to Building Regulations and BESA Technical Bulletin TB/032

Install and inspect fire stopping systems in accordance ASFP Code of Practice TDG17. Use proprietary systems, tested and assessed to BS EN 1366-3 and BS EN 1366-4 and classified to BS EN 13501-2.

All products used, to have third party product certification by a scheme accredited by UKAS.

Only use UKAS accredited, third party installer certified specialist contractors. The specialists should be ASFP members and their certification must cover the passive fire protection element they are installing.

Install all fire stopping systems in accordance with the manufacturer's written instructions and the test/assessment/certification evidence provided by the installer / manufacturer of the penetration seal.

Support centres for services passing through penetration seals serving fire barriers to be the same as those covered by the test/assessment/certification evidence provided by the installer / manufacturer of the penetration seal.

Unless detailed otherwise pipe closers for plastic pipes to be stainless steel collar with fixing brackets with intumescent liner. Installation to be in accordance with the manufacturer's instructions and grouted/sealed using the manufacturer's proprietary compound/sealant.
Standards - Test to BS EN 1366-3 and BS EN 1363-1.

Fire resistance to match resistance of wall or floor.

Grooved joints
All grooved couplings, fittings, valves etc to be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

1020 FITTINGS:
For changes in direction use centreline radius/nominal bore of not less than 1.5 unless otherwise directed.
For reductions and enlargements use easy transition type with inclined angle not exceeding 30 degrees.
All fittings, pipe joints and flanges PN rating shall be suitable for hydraulic test pressure of the system (ie minimum of 1.5 times the maximum operating pressure).

1030 FABRICATED FITTINGS:
Use only with approval, if manufacturer's standard fittings are not available.

1041 PIPE JOINTS:
Obtain approval from Local Water Authority or Water Research Centre for materials used in water supplies.
Ensure pipe joints do not occur within elements of the building (walls, floors, partitions etc).
All pipe joints and flanges shall be suitable for hydraulic test pressure of the system.

2000 PRODUCTS/MATERIALS PIPELINES

2010A WELDED OR SEAMLESS STEEL TUBE TO BS EN 10255:

Material	: Carbon steel.
Standard	: BS EN 10255.
Dimensions	: Light, Medium, or Heavy as scheduled
	: Random single lengths, 4m to 7m.
Ends	: Screwed to relevant parts of BS EN 10226, taper thread, or plain as required.
Finish	: Varnished

2010D GALVANIZED STEEL PIPES TO BS EN 10255:
Material - Carbon steel
Standard - BS EN 10255
Dimensions - Medium. Random single lengths, 4m to 7m.
Ends - Screwed to relevant parts of BS EN 10226 taper thread, or G.A.M. Flanged as required.
Finish – Galvanized to BS EN 10240.

2012A LIGHT GAUGE CARBON STEEL FOR PUSH-FIT AND PRESS-FIT SYSTEMS:
Application - for closed heating and cooling water circuits.
Standard – Manufacturer’s standard
Material - Carbon steel.
Dimensions – Manufacturer’s standard
Ends - Plain.
Finish – Galvanised to BS EN 10240 externally or plastic coated

2031 SEAMLESS CARBON STEEL TUBE TO BS EN 10216 -1 or BS EN 10216-2
With specified elevated temperature properties for industrial applications.
Material - Carbon steel
Standard – as above
Grade – to suit the application
Dimensions – BS EN 10220, BS EN 10216
Ends – Plain or grooved to ANSI / AWWA C606
Finish - Standard mill protective coating.

2050 WELDED STEEL TUBES TO BS EN 10217-1:

Material - grade

Grade P195TR1 or Grade P235TR1 to suit the application.

Dimensions

BS EN 10220

BS EN 10217-1, table 5

2055 WELDED STEEL TUBES TO BS EN 10217-2:

With specified elevated temperature properties for industrial applications.

Material - non-alloy and alloy steel.

Grade P195GH, or Grade P235GH or Grade P265GH to suit the application.

Dimensions

BS EN 10220

BS EN 10217-2, table 6

2061 CARBON STEEL FITTINGS, BUTT WELDED TO BS EN 10253:

Material	: Carbon steel, grade S235 or P235TR2 or P265TR2 to suit service requirements.
	: Electric resistance welded.
Standards	: BS EN 10253 -1 (without specific inspection requirements)
	: BS EN 10253-2 type B fittings (with specific inspection requirements for use on applications covered by the Pressure Equipment (Safety) Regulations 2016 - see schedule
Dimensions	: BS EN 10253 (medium or heavyweight as scheduled).

Ends and Finish to suit pipework.

2070 MALLEABLE CAST IRON FITTINGS, SCREWED:

Material	: Malleable cast iron to BS EN 1562.
Standard	: BS 143/1256 or BS EN 10242
Size range	: 10mm to 164mm.
Dimensions	: As standard.
Ends	: Screwed to relevant parts of BS EN 10226
Finish	: To match pipework.

2081 DUCTILE CAST IRON and STEEL FITTINGS, GROOVED FOR MECHANICAL JOINTS:

Material	: Ductile cast iron to ASTM A-536, grade 54-45-12
	Or steel fittings to ASTM A-234 or factory fabricated from ASTM A-53 steel pipe.
Standard	: Manufacturer's.
Size range	: 20mm to 600mm.
Dimensions	: Manufacturer's standard.
Ends	: Grooved for mechanical coupling joints.
Finish	: To suit pipework.

2091 WROUGHT STEEL FITTINGS, SCREWED TO BS EN 10241

Material	: Wrought steel, welded.
Standard	: BS EN 10241.
Size range	: 6mm to 150mm.
Dimensions	: BS EN 10241.
Ends	: Screwed to relevant parts of BS EN 10226
Finish	: To match pipework

2101 WROUGHT CARBON AND FERRITIC ALLOY STEEL FITTINGS TO BS 1640 PART 3:

Material	: Steel to BS 1640 Part 3, table 1.
Standard	: BS 1640 Part 3.
	Wrought seamless.
Size range	: 20mm to 600mm.
Dimensions	: BS 1640 Part 3.
Ends	: Plain or Bevelled as BS 1640 Part 3.

Finish : To match pipework.

2220 LIGHT GAUGE STAINLESS STEEL TO BS EN 10312 FOR WATER APPLICATIONS:
For use with push and pressfit piping systems for potable water, treated water, heating water and open and closed cooling water circuits.
Material - Stainless steel, Austenitic grade 316 (1.4401)
Standard - BS EN 10312.
Dimensions - BS EN 10312 as per tables 1 and 2.
Ends - Plain.
Finish - Uncoated.

2221 LIGHT GAUGE STAINLESS STEEL - MANUFACTURER'S STANDARD:
For use with push and pressfit piping systems for potable water, treated water, heating water and open and closed cooling water circuits.
Material - Stainless steel, Austenitic grade 316 (1.4401)
Standard –Manufacturer's standard.
Dimensions – Manufacturer's standard
Ends - Plain.
Finish - Uncoated.

2250A AUSTENITIC STAINLESS STEEL (SEAMLESS TUBE):
Material - Austenitic stainless steel.
Grade - 316L unless scheduled otherwise
Standard - BS EN 10216-5 for gen purpose
BS 4825-1 for food and other hygienic applications
Dimensions - BS EN ISO 1127.
Rubber gaskets as appropriate to BS ISO 48
Ends - Plain.
Finish - Uncoated.

2250B AUSTENITIC STAINLESS STEEL (WELDED TUBE):
Material - Austenitic stainless steel.
Grade - 316L unless scheduled otherwise
Standards
BS EN 10217-7 for general purposes
BS EN 10357 for food and chemical industry applications
Dimensions - BS EN ISO 1127.
Ends - Plain
Finish - Uncoated.

2255A STAINLESS STEEL FITTINGS, GROOVED MECHANICAL JOINTS:
Material - Stainless steel grades 304, 316, 316L, 316T, schedules 5S, 10S, 20S, 40S: ASTM A403 or factory-fabricated from ASTM A312 steel pipe.
Standard - Manufacturer's.
Size range - 20mm to 600mm.
Dimensions - Manufacturer's standard.
Ends - Grooved for mechanical joints; Schedule 5S and 10S pipe grooved with 'RX' roll grooves.
Finish - Natural.

2257 STAINLESS STEEL PUSH-FIT FITTINGS
Material - Stainless steel grade 316
Standard - Manufacturer's standard, electrically continuous.
Size range - 15mm to 54mm.
Dimensions - to suit stainless steel pipe to BS EN 10312, BS EN 10216-5 or BS EN 10217-7
Ends - push-fit with EPDM O ring.
Finish - Natural.
Jointing - Provide manufacturer's recommended tool for releasing push-fit fittings in push-fit jointing systems

2258 CARBON STEEL PUSH-FIT FITTINGS:
Material - Carbon steel.
Standard - Manufacturer's standard.
Size range - 15mm to 54mm.

Dimensions - to suit carbon steel pipe to BS EN 10305-3.
Ends - push-fit with EPDM O ring.
Finish - Galvanised.
Jointing - Provide manufacturer's recommended tool for releasing push-fit fittings in push-fit jointing systems.

2260A COPPER, ANNEALED (SOFT):
Material - Copper.
Standard - BS EN 1057, R220 coiled tube.
Dimensions - BS EN 1057 table 3.
Ends - Plain.
Finish - Uncoated.

2271 COPPER, HALF HARD:
Material - Copper
Standard BS EN 1057, R250
Dimensions -as BS EN 1057 table 3
Ends – Plain or grooved for mechanical joints
Finish - Uncoated or Chromium plated as scheduled.

2272 POLYETHYLENE SHEATHED COPPER (HALF HARD OR SOFT):
Material - Copper.
Standard - BS EN 13349 and BS EN 1057, R220 or R250 as scheduled.
Dimensions - BS EN 1057 table 3.
Ends - Plain
Finish - Sheathed in polyethylene (colour to suit application) or Sheathed in profiled white polyethylene (air channels on the internal surface) as scheduled.

2290A COPPER, HARD:
Material - Copper.
Standard - BS EN 1057, R290.
Dimensions - BS EN 1057 table 3.
Ends - Plain.
Finish - Uncoated.

2292 COPPER TUBE FOR REFRIGERATION:
Material - seamless copper.
Standards
BS EN 12735-1 for tubes for air conditioning and refrigeration piping systems
BS EN 12735-2 for tubes for equipment
Ends - Plain.
Finish - Uncoated.

2294 COPPER TUBE FOR MEDICAL GASES / VACUUM INSTALLATIONS:
Material - degreased copper
Standards - BS EN 13348 and HTM 02
Ends - Plain.
Finish - Uncoated.

2311 CAPILLARY FITTINGS FOR COPPER TUBING GENERAL POTABLE RANGE

Material	: Copper or Copper alloy (non-dezincifiable).
Standard	: BS EN 1254-1.
Size range	: 6mm to 67mm
Dimensions	: BS EN 1254-1.
Ends	: Socket - pre-soldered or plain.
Finish	: Natural cast.

2316 PRESS FITTINGS FOR COPPER TUBING:
Material
Copper or dezincifiable resistant copper alloy or gunmetal

Gunmetal.
Standard - Manufacturer's standard, electrically continuous.
Size range - 15mm to 108mm.
Dimensions - to suit copper tube to BS EN 1057.
Ends - with EPDM or Butyl rubber O ring for use with water, Acrylonitrile butadiene rubber for use with natural gas
Finish - Natural.

2321 COMPRESSION FITTINGS FOR COPPER TUBING

Material	: Copper or Copper alloy (dezincification resistant).
Standard	: BS EN 1254 -2 Type A non manipulative
Size range	: 6mm to 67mm
Dimensions	: BS EN 1254-2.
Ends	: Socket
Finish	: Natural

2322 SOLDER

All Fittings used on Water services shall have lead free solder.

2325 PUSH-FIT FITTINGS FOR COPPER TUBING:

Material – Dezincification resistant copper alloy and brass.
Standard - Manufacturer's standard, electrically continuous.
Size range - 15mm to 54mm.
Dimensions - to suit copper tube to BS EN 1057.
Ends - push-fit with EPDM O ring.
Finish - Natural.

2351 CAST IRON PIPES AND FITTINGS TO BS 416 PART 1:

Material - Cast grey or ductile iron.
Standard - BS 416, spun.
Dimensions - BS 416.
Ends - Socket type A or B.
Finish - Hot dipped to BS 416.

2391 GREY CAST IRON PIPES AND FITTINGS TO BS EN 877:

Material - Cast iron.
Standard - BS EN 877.
Dimensions - BS EN 877, table 1.
Ends - Plain.
Finish - Grey epoxy.

2431 LAYERED PIPE AND FITTINGS FOR HOT AND COLD WATER HEATING AND CHILLED WATER:

Multi-layer pipe systems for indoor hot and cold water installations and heating systems manufactured and installed as a complete system from a single manufacturer including pipes, fittings, tools, etc.

Design Parameters

The pipe shall have a continuous temperature rating of 95^0C (and be capable of withstanding short durations at temperatures of up to 110^0C.)
The pipe shall have a maximum working pressure rating of 10 Bar and useful life expectancy of 50 years.

Standards

Manufactured to relevant parts of BS EN ISO 21003 to under a certified quality assurance scheme which meets the BS EN ISO 9001 standard. The pipe and fittings shall be tested and approved by WRAS and carry a current WRAS certificate.

Materials

As scheduled or described in the scope of work for each system.

Pipe Construction

The pipe shall have details of manufacturer, materials, maximum pressure and maximum temperature printed \on the outer wall.

The multilayer pipe shall be a composite pipe comprising a continuous aluminium oxygen barrier sandwiched between an inner and outer layer of cross linked polyethylene PE-X.
The aluminium oxygen barrier shall be a minimum of 0.4mm thick and continuously butt welded.

Jointing / workmanship

DZR brass compression, DZR brass press fit or PVDF press fit jointing systems. The jointing systems shall have the same design parameters as the pipe.

The cutting and jointing of the pipe shall be undertaken using only those tools recommended by the manufacturer.

All pipes shall be calibrated and chamfered using the appropriate tool prior to joining.
Brass or metal fittings shall incorporate a captive Teflon seating ring to prevent electrolytic action between the oxygen barrier and fitting.
The outer shroud of any press fittings shall have an inspection hole which shall allow the installer to determine whether the pipe has been pushed fully into the fitting.
The leading edge of any inserts shall be tapered to reduce the risk of debris building up at the fitting.
Final connections to sanitary ware, appliances or equipment shall be achieved using WRAS approved flexible connections with integral servicing valves.
For all sizes up to 32mm long radius bends shall be formed by hand. Short Radius bends shall be formed using a bending spring or proprietary bending machine. For details contact manufacturer.
Multilayer Pipes shall be cut with a guillotine or ratchet type blade cutter of a design approved by the manufacturer.

Support spacing

Multilayer pipe shall be fixed in accordance with the maximum spacing details as follows:-

Pipe Size	Maximum Spacing
14 x 2mm pipe	1.0m
16 x 2mm pipe	1.0m
18 x 2mm pipe	1.25m
20 x 2mm pipe	1.25m
26 x 3mm pipe	1.5m
32 x 3mm pipe	2.0m
40 x 3.5mm pipe	2.0m
50 x 4mm pipe	2.0m
63 x 4.5mm pipe	2.0m

Where a branch or bend is installed brackets shall be installed within 300mm of the fitting.

2442 PLASTIC PIPING SYSTEMS TO BS EN 15014:
Standard - BS EN 15014.
Application - Buried and above ground systems for water (not potable) and other fluids under pressure.
Performance characteristics for pipes, fittings and their joints.
Performance characteristics - reaction to fire; external pressure strength; internal pressure strength; dimensional tolerance; tightness (air and water); durability; dangerous substances.

2455 PLASTICS PIPING SYSTEMS FOR WATER SUPPLY – PIPES TO BS EN 1452:
Material - Unplasticised polyvinyl chloride (PVC-U).
Standard - BS EN 1452-2.
Dimensions
Length - manufacturer's standard range.
BS EN 1452-2 tables 1, 2, 3, 4 and 5.
Ends
Plain or socket and spigot for solvent cement.
Finish
Blue or grey.

2475 PLASTICS PIPING SYSTEMS FOR WATER SUPPLY –FITTINGS TO BS EN 1452:
Material - Unplasticised polyvinyl chloride (PVC-U).
Standard - BS EN 1452-3.
Size range - 12mm 315mm
Dimensions
Length - manufacturer's standard range.
BS EN 1452-2 tables 1, 2, 3, 4 and 5.
Ends
Plain.
Socket and spigot for solvent cement.
Finish - Grey..

2480 UNPLASTICIZED PVC TO BS 4514:
Material - Unplasticized PVC.
Standard - BS 4514.
Dimensions - BS 4514.
Ends
Plain.
Socket to BS 4514, solvent cement.
Finish
Grey.

2490 UNPLASTICIZED PVC FITTINGS, SOLVENT WELDING TO BS 4514:
Material - Unplasticized PVC.
Standard - BS 4514, table 2.
Size range - 82mm, 110mm or 160mm.
Dimensions - BS 4514, tables 3 and 5.
Ends - Spigot/plain.
Finish - grey

2495 PLASTICS PIPING SYSTEMS TO BS EN 1453-1:
Plastics piping system with structured-wall pipes for soil and waste discharge (low and high temperature) within building structure.
Material - Unplasticised polyvinyl chloride (PVC-U).
Standard - BS EN 1453-1.
Dimensions
Length - manufacturer's standard range.
BS EN 1453-1 tables 1, 2 and 3.
Ends – Plain or elastomeric ring seal socket and spigot or socket and spigot for solvent cement.
Finish - Grey or white as indicated.

2525A BURIED POLYETHYLENE PIPES FOR GASEOUS FUELS TO BS ISO 4437:
PE Pipes, including any identification tapes.
Material - Polyethylene (PE).
Standard - BS ISO 4437.
Dimensions - BS ISO 4437, Table 5.
Ends - Plain for butt fused joints.
Finish - yellow.

2528 POLYETHYLENE PIPES FOR GASEOUS FUELS TO BS EN 1555:
Material - Polyethylene.
Standard - BS EN 1555-1, BS EN 1555-2 and BS EN 1555-5.
Dimensions - BS EN 1555-2, table 1.
Lengths - straight pipe 6m or 12m.
Lengths - coiled pipe multiples of 50m.
Marking - BS EN 1555-2, table 7.
Ends – Plain.
Finish
Yellow

2531

POLYETHYLENE FITTINGS, FUSION TO GIS/PL2 PART 2:
Material : Polyethylene.
Standard : To GIS/PL2 Part 2.

Size range	: Socket type up to 125mm.
	: Butt type up to 500mm.
	: Saddle type up to 180mm.
Dimensions	: To GIS/PL2 Part 2.
Ends	: Plain.
Finish	: Natural self-colour.

2538 POLYETHYLENE FUSION FITTINGS TO BS EN 1555:

Material - Polyethylene.
Standard - BS EN 1555-1, BS EN 1555-3 and BS EN 1555-5.
Dimensions - BS EN 1555-3, Section 6, to suit pipes to BS EN 1555-2.
Marking - BS EN 1555-3, table 7.
Ends - Sockets with heating elements for fusion jointing.
Finish
Yellow.

2545 PLASTICS PIPING SYSTEMS BS EN 1451 - PIPES:

Plastics piping system for soil and waste discharge (low and high temperature) within building structure.)
Material - Polypropylene (PP).
Standard - BS EN 1451-1 and BS EN 15012.
Dimensions
Length - manufacturer's standard range.
BS EN 1451 tables 1, 2, 3 and 4.
Ends
Socket and spigot for solvent cement.
Finish
Black.

2553 PLASTICS PIPING SYSTEMS FOR NON-PRESSURE UNDERGROUND DRAINAGE AND SEWERAGE - STRUCTURED WALL PIPING SYSTEMS OF PVC-U, PP AND PE:

Standards – BS EN 13476-1 and BS EN 13476-2 or BS EN 13476-3
Material
Poly vinyl chloride (PVC-U).
Polypropylene (PP).
Polyethylene (PE).
Type A - Pipes and fittings with smooth internal and external surface.
Type B - Pipes and fittings with smooth internal and profiled external surface.

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2555 PLASTICS PIPING SYSTEMS TO BS EN 1451 - FITTINGS:

Plastics piping system for soil and waste discharge (low and high temperature) within building structure.)
Material - Polypropylene (PP).
Standard - BS EN 1451-1 and BS EN 15012
Size range - 32mm to 315mm.
Dimensions - BS EN 1451 tables 5 - 8.
Ends
Plain.
Elastomeric ring seal socket and spigot.
Socket and spigot for solvent cement.
Finish
Black.

2580A SOLID WALL PVC-U PIPING SYSTEMS – PIPES / FITTINGS:

Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
Material - Unplasticised polyvinyl chloride (PVC-U).
Standard - PVC-U to BS EN 1329-1 and BS 4514 as appropriate to the application.
Size range - 32mm to 315mm.
Dimensions - Length - manufacturer's standard range. BS EN 1329-1 tables 1-4 & 5-14
Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
Finish - Grey, black, or white.

2580B SOLID WALL PVC-U PIPING SYSTEMS – PIPES / FITTINGS (with upto 65% recycled PVC):

Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.

Material - Unplasticised polyvinyl chloride (PVC-U) to BS EN 1453-1 with upto 65% recycled PVC of total wall thickness.
Multi-layer extrusion consisting of:
An outer layer of virgin PVC (Grey).
A middle layer of recycled PVC up to 65% of total wall thickness.
The inner layer of (unpigmented virgin PVC)
Standard - BS EN 1453-1 and BS EN 1329-1 for PVC pipe and fittings are considered a system.
There is no difference in pipe performance or dimensional data, and impact performance meets the minimum required results from both standards
Size range – 110mm + 160mm
Dimensions - Length - manufacturer's standard range.
Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
Finish - Grey, black, or white.

2580C PE PIPING SYSTEMS - PIPES:

Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
Material - Polyethylene (PE).
Standard - PE to BS EN 1519-1.
Dimensions - Length - manufacturer's standard range.BS EN 1519-1 tables 2-5 & 6-10.
Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
Finish - Grey, black, or white.

2580F STRUCTURED-WALL PVC-U PIPING SYSTEMS - PIPES:

Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
Material - Unplasticised polyvinyl chloride (PVC-U).
Standard – Structure-wall PVC-U to BS EN 1453-1
Dimensions - manufacturer's standard range. BS EN 1453-1.
Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
Finish - Grey.

2595 PLASTICS PIPING SYSTEMS TO BS EN ISO 15874:

Plastics piping systems for hot and cold water installations, including heating, within buildings.
Material - Polypropylene (PP).
Standards
BS EN ISO 15874-1 - General
BS EN ISO 15874-2 - Pipes
BS EN ISO 15784-3 - Fittings
BS EN ISO 15784-5 - Fitness for purpose of system
Dimensions - manufacturer's standard range.
Pipe ends - Plain, socket for fusion fittings, socket for electrofusion fittings, for mechanical fittings or fittings with incorporated inserts.
Fittings ends - Plain, socket fusion fittings, electrofusion fittings, mechanical fittings or fittings with incorporated fittings

2597 PLASTICS PIPING SYSTEMS TO BS EN ISO 15875:

Plastics piping systems for hot and cold water installations, including heating, within buildings.
Material - Crosslinked polyethylene (PE-X).
Standards
BS EN ISO 15875-1 - General
BS EN ISO 15875-2 - Pipes
BS EN ISO 15875-3 - Fittings
BS EN ISO 15875-5 - Fitness for purpose of the system
Dimensions - manufacturer's standard range.
Ends - Plain, suitable for electrofusion fittings, mechanical fittings, or fittings with incorporated inserts.
Fitting ends - Plain, socket fusion fittings, electrofusion fittings, mechanical fittings or fittings with incorporated fittings

2599 PLASTICS PIPING SYSTEMS TO BS EN ISO 15876:

Plastics piping systems for hot and cold water systems, including heating, within buildings.
Material - polybutylene (PB).
Standards:

BS EN ISO 15876-1 - General
BS EN ISO 15876-2 - Pipes
BS EN ISO 15786-3 - Fittings
BS EN ISO 15876-5 - Fitness for purpose of the system
Dimensions - manufacturer's standard range.
Ends - Plain, sockets for fusion fittings, suitable for electrofusion fittings, mechanical fittings, or fittings with incorporated inserts.
Fittings ends - Plain, socket fusion fittings, electrofusion fittings, mechanical fittings or fittings with incorporated fittings.
Finish - Natural or coloured.

2601 PLASTICS PIPING SYSTEMS TO BS EN ISO 15877:
Plastics piping systems for hot and cold water installations within buildings.
Material - chlorinated poly(vinyl chloride) (PVC-C).
Standards
BS EN ISO 15877-1 - General
BS EN ISO 15877-2 - Pipes
BS EN ISO 15877-3 - Fittings
BS EN ISO 15877-5 - Fitness for purpose of the system
Dimensions - manufacturer's standard range.
Pipe ends - Plain, single socket.
Fittings ends - Plain, cylindrical sockets or conical sockets.

2603 PLASTICS PIPING SYSTEMS TO BS EN ISO 22391:
Plastics piping systems for hot and cold water installations within buildings.
Material - Polyethylene of raised temperature resistance (PE-RT).
Standards
BS EN ISO 22391-1 - General
BS EN ISO 22391-2 - Pipes
BS EN ISO 22391-3 - Fittings
BS EN ISO 22391-5 - Fitness for purpose of the system
Dimensions - Length and wall thickness - manufacturer's standard range.
Pipe ends - Plain, single socket.
Fittings ends - Plain, cylindrical sockets or conical sockets

2630 ABS TO BS 5391 PART 1:
Material - ABS (Acrylonitrile-butadiene-styrene).
Standard
BS 5391 Part 1, class B ,C,D, or E to match system working pressure.
Dimensions
BS 5391 Part 1, table 1 - lengths 3m, 6m and 9m.
Ends
Plain.
Finish - Natural.

2640 ABS FITTINGS, SOLVENT WELDING TO BS 5392 PART 1:
Material - ABS (Acrylonitrile-butadiene-styrene).
Standard
BS 5392 Part 1, class B,C,D,or E to match system working pressure
Size range - 10mm to 200mm.
Dimensions - BS 5392 Part 1, table 1.
Ends - Spigot/socket.
Finish - Natural.

2665A POLYETHYLENE TO WIS 4-32-17:
Material - Polyethylene.
Standard - WIS 4-32-17.
Dimensions - WIS 4-32-17 table 6.
Lengths - straight pipe 6m, 12m or 18m; coils, 25m, 50m, 100m or 150m.
Ends - Plain.

2668 POLYETHYLENE PIPES TO BS EN 12201:
Material - Polyethylene.
Standard - BS EN 12201-1, BS EN 12201-2, BS EN 12201-5
Dimensions

BS EN 12201-2, table 1
Lengths
Straight pipe 6m, 9m or 12m.
Coils 50m, 100m or 150m.
Manufacturer's standard.
Marking
BS EN 12201-2, table 6
Ends
Plain.
Finish
Blue.

2669 POLYETHYLENE FITTINGS TO BS EN 12201:
Material - Polyethylene.
Standard - BS EN 12201-3.
Type
Electrofusion.
Dimensions
BS EN 12201-3, section 6 and Annex A.
Marking
BS EN 12201-3, table 7.
Ends - Plain.
Finish
Blue.

2705A PLASTICS PIPES / FITTINGS TO BS 7291:
Thermoplastics pipe and fitting systems for hot and cold water for domestic purposes and heating installations in buildings
General requirements - BS 7291-1
Material - Polybutylene (PB) BS 7291-2; or crosslinked polyethylene (PE-X) BS 7291-3.
Standard - BS 7291.Classification H unless otherwise indicated.
Dimensions - BS 7291-2 (PB) or BS 7291-3 (PE-X); Table 1 (CU) or Table 2 in accordance with BS ISO 11922-1, BS ISO 4065 or to BS ISO 161-1.
Ends - Plain.flanged or screwed to suit method of jointing
Finish - Natural.

2707 PUSH-FIT FITTINGS FOR PE-X AND PB TUBING:
Material - Dezincifiable resistant copper, copper alloy and brass.
Standard - Manufacturer’s standard.
Size range - 10mm to 28mm.
Dimensions - to suit PE-x and PB tube.
Ends - push-fit.
Finish - Natural.

2710 VULCATHENE:
Material
Polypropylene suitable for laboratory drainage.
Standard - To manufacturer’s standard (No BS available).
Dimensions
Nominal diameter 38mm to 152mm available, standard length 4m.
Ends - Plain.
Finish - Black.
Joints
Electro fusion welded

2720 VULCATHENE FITTINGS:
Material
Polypropylene.
Standard - To manufacturer’s standard (No BS available).
Size range - Nominal diameter 38mm to 152mm.
Dimensions - Nominal diameter 38mm to 152mm available.
Ends
Socket for heat fusion jointing.

Finish - Black.

2731 PLASTIC PIPING SYSTEMS FOR INDUSTRIAL APPLICATIONS:
Material – As scheduled.
Standards
BS EN ISO 15493 for ABS, PVC-U or PVC-C
BS EN ISO 15494 for PB, PE, PE-RT, PE-X or PP

2741 GLASS PIPELINE

Material	: Borosilicate glass 3.3.
Standard	: BS EN 1595.
Dimensions	: BS EN 12585
Ends	: Spherical or flat buttress.
Finish	: Natural self finish.

2742 STAINLESS STEEL PLIABLECORRUGATED TUBING KIT FOR GAS UP TO 0.5 BAR:
Standards
BS 7838
BS EN 15266 Stainless steel pliable corrugated tubing kits in buildings for gas with an operating pressure up to 0.5 bar.
The tubing shall be complete with a non metallic yellow ochre cover which shall be fire and smoke retardant and marked “GAS”.
Fittings
Must be provided by the tubing kit manufacturers
Installation
In accordance with the tubing kit manufacturer’s recommendations and BS 6891 for pipework up to 35mm or IGE/UP/2, IGE/UP/1. Movable appliances must not be connected to corrugated tubing. Install the tubing in a purpose designed sleeve where it passes through an unventilated void.

2881 PRE- INSULATED UNDERGROUND BONDED PIPE SYSTEMS - STEEL
Supply pre-insulated bonded pipe systems for underground networks and district heating, designed, installed and tested in accordance with parts 1 and 2 of BS EN 13941.

For twin pipe systems comply with BS EN 15698-1.

To comprise, straight lengths of prefabricated thermally insulated pipe-in-pipe assemblies comprising mild steel service pipes, polyurethane thermal insulation and high density polyethylene outer casing to BS EN 253.

Provide fitting assemblies in accordance with BS EN 448, steel valve assemblies in accordance with BS EN 488 and BS EN 15698-2 (fitting & valve assembly for twin pipe systems). Joint assemblies in accordance with BS EN 489-1.

Installation to be in accordance with the manufacturer's instructions.

Provide leak detection and location equipment as scheduled.
Supply surveillance systems for pre-insulated bonded pipe systems in accordance with BS EN 14419 as detailed in the scope of works.
Unless scheduled otherwise the service life expectancy shall be greater than 50 years when operating at 80^{o}C for a minimum of 12 hrs, 365 days/year.

2882 PRE-INSULATED FLEXIBLE INSULATED UNDERGROUND PIPELINES – METAL AND PLASTIC SERVICE PIPES
Standard

Bonded flexible plastic service pipes to BS EN 15632-1, BS EN 15632-2
Non-bonded flexible pipe system with plastic service pipes to BS EN 15632-1 and BS EN 15632-3
Bonded flexible pipe system with metal service pipes to BS EN 15632-1 and BS EN 15632-4
Dimensions as manufacturer's standard.
Fittings, as manufacturer's standard.
Finish, as manufacturer's standard
Supply pre-insulated pipe systems for underground networks. The detail design and installation of the system shall be in accordance with the manufacturer's recommendations. This shall include all trenching details, wall entry details and all provisions for thermal expansion. Manufacturer's proprietary fittings shall be used for tee pieces, elbows, branches, wall entry kits etc. Whenever possible these should be pre-fabricated / pre-insulated fittings to minimize on site work.
The internal carrier pipe system shall be of Polybutene material (PB1)
Jointing Method ---- Electrofusion Welding / butt fusion welding

PE-Xa may be offered as an alternative to PB on systems with operating temperature up to 70 - 80^0 C and pipe sizes up to DN 150 (130mm ID). However this pipe system uses mechanical compression type joints and therefore joint inspection pits must be provided at all pipe joints / branches.

For carrier pipe sizes up to DN 100 (110mm OD plastic) use coiled pipe. The insulation shall be continuous in line extruded PE (polyethylene) foam surround, fusion bonded to the outer casing. The outer casing shall be made of corrugated black PE.

For carrier pipe sizes from DN 125 to DN 200, (222mm OD plastic) use straight lengths> The insulation shall be continuous PU (polyurethane) foam in 6 or 12m lengths. The outer casing shall be made from smooth outer PE pipe Carrier pipes and shall be jointed by butt fusion method.

Full material damage resistance - No loss of insulation integrity allowed where surface damage may occur.
Max temperature / pressure rating 95^o C @ 8bar
Thermal conductivity: 0.031W/mK @40^o C

The specialist contractor shall confirm the life expectancy of the proposed system based on the project specific operating temperature / pressure and estimated annual operating time as defined elsewhere in this specification.
Unless scheduled otherwise the service life expectancy shall be greater than 50 years when operating at 80^{o}C for a minimum of 12 hrs, 365 days/year.

3012 CIRCULAR FLANGES FOR PIPES AND FITTINGS:

Material : Ferritic steel, BS EN 1092-1
Cast iron, BS EN 1092-2
Aluminium alloy BS EN 1092-4
Flange type : Hubbed slip-on flange for welding.
Associated bolts, nuts and washers:

For ferrous and composite flanges
: Interior use - Black mild steel
: Exterior use - Cadmium plated to BS 7371-12
For copper alloy flanges use high tensile brass.
Bolts to be of suitable length so as to show no more than three threads past the nut
Flange facings : Raised face.

3021 FLANGE JOINTING RINGS:

Non metallic flat gaskets for flanges to BS EN 1092-1, or BS EN 1092-2 or BS EN 1092-3 or BS EN 1092-4
Standard – relevant parts of BS EN 1514
Full face.
Supply joint rings manufactured from:-
Asbestos free compressed synthetic fibre with suitable binder for the operating conditions.

3031 SCREWED JOINT TO BS EN 10226:

Use PTFE tape to BS 7786 or use hemp and jointing compound to BS 6956 Part 5 or BS EN 751-2 6956 Part 6, prior to chemical treatment and use PTFE tape to BS 7786 after chemical treatment.

3041 UNION CONNECTIONS:
Seating:
Spherical seating:- bronze to bronze, navy pattern.

3051 WELDED JOINTS:
For steel pipes use welding rods as follows:
Gas welding, BS EN 12536 type A2 or A3; electric arc welding BS 2633; or electric arc welding BS 2971.
For copper pipes use bronze welding to BS EN 12536.

3061 BRAZED JOINTS:
Use filler metals to BS ISO 17672
For zinc free brazed joints use nickel bearing zinc free grades of filler metals to BS ISO 17672

3071 CAPILLARY JOINTS:
Solder
BS EN ISO 9453
Use fittings in accordance with BS EN 1254 – 1 on potable water systems
Flux - Copper pipe Classification, labelling and packaging to BS EN ISO 9454-1 and performance requirements to BS EN ISO 9454-2.
Do not use grease-based fluxes. Use partially water-soluble flux approved by WRAS.
Stainless steel pipe - BS 5245

3080 JOINTING EQUIPMENT FOR MULTI-LAYER PIPE SYSTEM:
Provide the Manufacturer's recommended compression tool for making connections in the multi-layer pipe system.

3091 FLEXIBLE JOINTS, CAST IRON PIPES:
Use half housings of cast iron in accordance with BS 877, together with coupling gaskets of nitrile rubber in accordance with, BS 7874 BS EN 681-1, BS EN 682 BS EN 681-1 and bolt joints using stainless steel bolts and nuts.

3095A JOINTING MATERIALS FOR PLASTICS PIPES TO BS 7291:
Plastics fittings to BS 7291.
Method of jointing to BS 5955 Part 8
Compression with fittings to BS EN 1254-3

3102 JOINTING EQUIPMENT FOR PUSH-FIT SYSTEM:
Provide manufacturer's recommended tool for releasing push-fit fittings in push-fit jointing systems for copper and plastic pipe.

3125 JOINTING EQUIPMENT FOR PRESS FITTING SYSTEM:
Provide the manufacturer's recommended press fitting tools including pressing tool, de-burring tool and insertion depth marker for use with press fitting system, these must be used for all joints.

3131 PRESS FITTING JOINTING SYSTEM ON STAINLESS STEEL PIPE:
Material
Stainless Steel.
Standard
To BS EN 10216 / 10217 or BS EN 10312.
Size range
15mm to 108mm for water.
15mm to 108mm for gas.
Dimensions - to suit stainless steel pipe to BS 10216/10217
Ends
With O ring seal for use with water or gas to suit application to manufacturer's standard.
Finish - Natural.

3132 PRESS FITTING JOINTING SYSTEM ON THIN WALL STEEL PIPE:
Material -Thin wall carbon steel pipe.

Standard - To Manufacturers standard and BS EN 10305-3
Size range - 12mm to 108mm.
Dimensions - to suit thin wall carbon steel pipe to BS EN 10305-3.
Ends - With EPDM O ring seal to manufacturer's standard.
Finish - Galvanised.

3135 PRESS FITTING JOINTING SYSTEM ON COPPER PIPE:

Material - Copper pipe.
Standard - To Manufacturers standard. Tube to BS EN 1057, fittings to BS EN 1254
Size range - 15mm to 108mm
Dimensions - to suit copper pipe to BS EN 1057.
Ends - with EPDM or Butyl rubber O ring for use with water, Acrylonitrile butadiene rubber for use with natural gas, all to manufacturer's standard.
Finish - To manufacturers standard
Comply with IGEM/UP/2 edition 3 Appendix 8 pressed fittings jointing procedure when used on natural gas pipework.

3141 MECHANICAL JOINTS, GROOVED STEEL PIPES:

Material - Ductile cast iron to ASTM A-536, grade 65-45-12.
Joint type
For applications where vibration attenuation and stress relief is required use flexible installation - ready 2 piece housing type.
Use rigid installation ready 2 piece housing with offsetting angle-pattern bolt pads where stress relief is not required. Fully installed at visual pad-to-pad offset contact.
For pipe sizes 350mm and above use 2 segment, wedge shaped grooved with lead-in chamfer on housing key.
Size range - 20mm to 600mm.
Gaskets - Grade 'E' EPDM; for pipe sizes 350mm and larger, wide-width proprietary gaskets selected and manufactured by the joint manufacturer.
Finish - Painted to manufacturer's standard.
Provide electrical continuity clip if required

3151 MECHANICAL JOINTS, GROOVED COPPER PIPES:

Material - Ductile cast iron to ASTM A-536, grade 65-45-12.
Joint - Installation-ready, rigid with offsetting angle-pattern bolt pads. Fully installed at visual pad-to-pad offset contact; copper-tubing sized (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.)
Size range - 54mm to 200mm.
Gaskets - Grade 'E' EPDM.
Finish - Painted to manufacturer's standard.

3190 WALL, FLOOR AND CEILING MASKING PLATES:

Materials	: Copper alloy, chromium plated.
Type	: Heavy, split on the diameter, close fitting to the outside wall of the pipe.
Fixing	: Chrome raised head fixing screws.

3200 PIPE RINGS AND CLIPS

Steel pipes
Use suitable pipe clips take into account the pipe load, material and pipe/insulation surface details.
Copper pipes
Use brass pipe clips

4000 WORKMANSHIP, GENERAL

4010 APPEARANCE:

Arrange all exposed pipe runs to present neat appearance, parallel with other pipe or service runs and building structure, subject to gradients for draining or venting.
Ensure all vertical pipes are plumb or follow building line.

4020 SPACING:

Space pipe runs in relation to one another, other services runs and building structure, allow for specified thickness of thermal insulation and ensure adequate space for access to pipe joints, etc.
The following are recommended as minimum clearances in spacing of pipe runs:-

Between	and	Clearance (mm)
Pipeline, insulated or uninsulated	wall finish	25
	ceiling finish or soffit	50
	floor finish	150
Insulated pipeline	adjacent service runs	25
uninsulated pipelines		50
adjacent pipelines	both uninsulated	150
	one uninsulated	75
	both insulated	25

4030 GRADIENTS:
Install pipework with gradients to allow drainage and/or air release,

4035 STEAM AND CONDENSE MAINS:
Comply with the requirements of BESA TR/20 part 8 following the guidance in CIBSE TM 58 and, the project specific requirements in the scope of works and schedules.
Refer to clause Y10.9021 for workmanship details.

4041 AIR VENT REQUIREMENTS:
Air Vent Assembly to be either
An air bottle i.e.
A vertical extension from the pipe approximately 100mm long, at the bore of the pipe with a copper extension pipe with a manual vent cock located in an easily accessible position.
or
An automatic air vent valve with a copper outlet pipe from the valve to a tundish in an adjacent drain line or to another suitable location.
Provide vents at all high points. Vent to be manual unless otherwise indicated.

4050 DRAIN REQUIREMENTS:
Grade pipework to allow system to be drained. Provide a means of draining the system at all low points.
On all cooling coils in AHU's provide drain trap of at least twice working air pressure in depth.

Provide an air break between trap outlet and drainage system. Pipe each trap to drain via a tun-dish or pipe each trap separately to discharge over a gully to prevent the potential of cross contamination between AHU's.
In permanent bypasses in any heating, cooling or geothermal distribution systems where the dead leg is more than 3 times pipe diameter suitably sized drain valves should be incorporated to facilitate draining and cleaning.

4061 EXPANSION AND CONTRACTION:
Arrange supports and fixings to accommodate pipe movement caused by the thermal changes, generally allow the flexure at changes in direction. Allow for movement at branch connections.
On drainage pipework use purpose designed fittings at changes of direction to accommodate movement, and to avoid stresses on connections to stacks.
Where possible provision for movement due to thermal expansion and contraction shall be made by natural changes in the direction of pipework.
Anchors and guides shall be positioned to contain all movement and resist the maximum loads imposed.

Anchors and guides are to be located at points which prevent excess stresses on pipework,

joints and equipment connections. Similar provisions shall be made for building movement or

building settlement.

For water systems, using a grooved pipework system, the proprietary flexible couplings may be used to accommodate thermal growth, contraction and for the elimination of expansion loops. The type, quantity required, locations and installation/support details of flexible couplings proposed shall be in accordance with the manufacturer's written recommendations and show on the installation drawings. Where loops are required, use flexible couplings on the loop.

Any provisions for expansion, anchors and guides shown on the drawings are for guidance, the actual requirements shall be determined by the Contractor.

The contractor shall utilize one of the named specialists and confirm in their tender submission that all provisions for pipework expansion have been included.

4065 CONNECTIONS BETWEEN PIPES OF DIFFERENT MATERIALS:

Plastic

Connect plastics pipework to pipework of other materials using approved connectors and methods in accordance with plastics pipework manufacturer's recommendations, to form a watertight joint.

Copper

Connect copper pipework to cast iron sockets using a caulking bush (brazed on), bitumenized yarn and an approved caulking compound neatly finished, to form a watertight joint, or connect copper pipework to cast iron using purpose made copper to iron connectors.

Galvanized steel

Connect galvanized steel pipework to cast iron sockets with bitumenized yarn and molten lead, lead wool or an approved cold caulking compound.

4071 PIPE FITTINGS:

Use eccentric type reductions and enlargements on horizontal pipe runs to allow draining and venting, concentric on vertical pipes, with easy transition and an included angle not exceeding 30 degree. Do not use bushes, except at radiators and at fittings where required size is not of standard manufacture. Where required, use eccentric bushes to allow draining or venting; maximum aspect ratio not to exceed two pipe sizes; above this ratio use reducing fittings. Use square tees at venting and draining points. Square elbows are not acceptable. Use bends and swept tees where practical, otherwise use elbows and square tees

4080 FABRICATED JUNCTIONS:

Form by inserting a branch section of a pulled bend into the main pipe. Develop the profiles of both the branch section and the hole in the main pipe, to ensure minimum protrusion into the main pipe. Weld or braze into position.

4090 FABRICATED FITTINGS - FERROUS:

Supply pipe material and end connections to the specification of the associated straight pipe runs.

Pattern

Bends, springs, offsets and branches.

Technique

Pipe bore 50mm or less - machine cold bend.

Pipe bore greater than 50mm - machine hot bend.

Ensure that fabricated branch bends of welding saddles are to the fitting proportions in BS EN 10253 – Parts 1 or 2 (depending on inspection requirements)

4105 ACOUSTIC INSULATION OF PIPEWORK

Material
Polymeric mass layer 10 kg/m^2
Standard -To manufacturer’s standard.
Thickness -20mm to 100mm
Lengths -1m
Finish -Reinforced aluminium foil (outer)
Fire resistance to BS 476-6 and BS 476-7.
Installation -To manufacturer’s standard.

4100 FABRICATED FITTINGS - NON-FERROUS:

Provide pipe material and end connections to the specification of the associated straight pipe runs.

Pattern

Bends, springs, offsets and branches.

Technique

Machine bend and ensure that machine guides and formers are smooth and clean, free from any scores, or other damage. Deformed bends will not be accepted.

Fabricate branch from a section of pulled bend, profiled to match the contour of the main to avoid overlap and protrusion into the main. Cut and swage the main to form a raised cup to accept the spigot end of the branch. Limit angle of the branch to 60o. Join by bronze welding on site. Apply reinforcement by plates, collars or shoes.

4110 PIPES THROUGH WALLS AND FLOORS:

Enclose pipes passing through building elements, (walls, floors, partitions, etc.) concentrically within purpose made sleeves. Fit masking plates where visible pipes pass through building elements, including false ceilings of occupied rooms.

Piped services (excluding gas pipes) that penetrate a floor separating habitable rooms in different flats within residential buildings shall be enclosed for their full height and full horizontal run in each flat and surrounded with sound absorbent material above and below the floor. The installation shall comply with the requirements of Approved Document E of the Building regulations. “Resistance to the passage of sound”.

4120 PIPE SLEEVES THROUGH NON FIRE RATED PARTITIONS / FLOORS:

Where pipe insulation is not carried through pipe sleeve, cut sleeves from material same as pipe one or two sizes larger than the pipe to allow clearance. Do not use sleeves as pipe supports.

Where pipe insulation is carried through pipe sleeve, cut sleeves from material same as pipe one or two sizes larger than pipe and insulation to allow clearance. Do not use sleeves as pipe supports.

Install sleeves flush with building finish. In areas where floors are washed down install with a 100mm protrusion above floor finish.

4125 PROPRIETARY PIPE SLEEVES THROUGH FIRE RATED PARTITIONS / FLOORS:

Where the insulation is to be carried through the partition - thermally insulated proprietary fire sleeves shall be used tested in accordance with the relevant parts of BS 476 or BS EN 1366-3 to meet the fire rating of the partition. The sleeves shall be either:

“Rockwool FirePro” Insulated fire sleeves comprising a combination of mineral wool and graphite intumescent or

“Pacifyer” one piece stainless steel sleeve with an intumescent lining the full length and 3 bands of acoustic foam adhered to the bore of the sleeve. Where the insulation is required to carry through the wall or partition / vapour seal is required oversized mineral wool shall be fitted to the pipework with an oversized Pacifyre fitted over the mineral wool

If ablative coated batt is used

All components and sealants / glue used must be tested to relevant parts of BS 476 or BS EN 1366-3 and BS ISO 5660-1, and be provided from a single manufacturer.

For plastic pipes, install a proprietary ablative coated batt in combination with a proprietary fire sleeve where the pipes pass through the batt. Ablative batt minimum density to be 180 kg/m3 and have a test certificate to match the fire resistance of the wall or partition and should have Loss Prevention Certification Board (LPCB) third party approval.

For metal pipes install proprietary fire rated insulation for 500mm either side of the batt. Standard - BS 3958-4

Installation – In accordance with the manufacturer’s requirements.

4131 CONNECTIONS TO EQUIPMENT:

Make final connections to equipment in accordance with manufacturer's instructions and as indicated. Provide flanges or unions to enable removal of equipment with minimum disassembly of pipework.

4141 DISTRIBUTION HEADERS:

Terminate ends with a cap, a blank flange or as otherwise indicated.

4151 TEMPORARY PLUGS, CAPS AND FLANGES:

Seal all open ends as installation proceeds by plugs, caps or blank flanges, to prevent ingress of foreign matter.
Plug material
Metal.
or Plastic.
or Wooden.
In the event of such precautions not being taken, strip out pipework adjacent to open ends to demonstrate that fouling of bores has not occurred.

4160 FLANGED JOINTS GENERAL:
Use number and diameters of bolts to standard. Fit bolts of length to give not less than one thread, or more than 3mm protrusion beyond nut when joint is pulled up.
Fit washers under each nut.

4170 DISSIMILAR METALS:
Take appropriate means to prevent galvanic action where dissimilar metals are connected together. For grooved systems use proprietary dielectric waterway fittings with high temperature LTHS stabilised polyolefin liner.

4175 ELECTRICAL BONDING TERMINAL:
Provide site made electrical bonding connection of 6-mm^2 conductor, or purpose made fitting across all non-conducting joints in any pipework systems.

4180 PIPE RINGS AND CLIPS:
Select type according to the application and material compatibility, give particular attention where pipes are subject to axial movement due to expansion or contraction.

4191 ANCHORS:
Construct to resist axial stress transmitted by flexure of horizontal and vertical pipe runs or loading on vertical pipes assuming that unbalanced forces exist at all anchor points, even when these are situated in intermediate positions between two expansion loops or bellows. Use similar or compatible materials to the attached pipe.
Provide and fix all associated backing plates, nuts, washers and bolts for attachment to or building into building structure; ensure structure is suitable for transmitted stress. Set out and line up anchors accurately in position. Inspect final grouting into building structure.
Steel Pipes
Construct using mild steel overstraps or heavy U-bolts. Secure to channel section, adequately attached to or grouted into building structure; weld longitudinal edges of strap to pipe.
or Pass two slip-on flanges over pipe to anchor point. Bolt together through an interposed mild steel channel section attached to or grouted into building structure, and finally weld flanges to pipe.
or Provide purpose designed anchors.
Copper Pipes
Fit two flanges to copper female adaptors in pipe run at anchor point. Bolt together through an interposed mild steel channel section attached to or grouted into building structure.
or Fit saddle clamps in pipe run at anchor point.
or Provide purpose designed anchors.
PVC Pipes
Clamp pipework to mild steel channel section attached to or grouted into building structure, using PVC coated overstraps, or clamps and with a polypropylene strip between pipe and mild steel section.

4201 SLIDE GUIDES:
Direct movement of expansion and contraction from pipe anchor points towards loops, bellows or flexible inserts. Ensure that thrust is linear relative to the axis of pipe.
Apply a friction reducing material between metal faces subjected to movement.

4207 PIPE SUPPORTS:
Arrange supports and accessories for equipment, appliances or ancillary fitments in pipe runs, so that no undue strain is imposed upon pipes.

Ensure that materials used for supports are compatible with pipeline materials. Unless otherwise indicated support DX pipes on galvanised cable tray suitably sized (both width and depth) for the pipes to be carried (to be able to support the pipes without sagging). Gusseted bends shall be used where required to match the radius of the pipe bends.
For grooved systems, pipework supports to fully comply with the manufacturer's instructions, submit calculations from the system manufacturer to demonstrate adequate allowance has been made for thermal expansion of the system.
Proprietary suspension systems to comprising channel sections with return sections with return lips and compatible fixing accessories made of material to BS EN 10162, BS EN 10210 and/or slotted angles to BS 4345.
Ensure support components for galvanised pipes have the same finishing method as the pipe carried out after manufacture.
Ensure all steel components such as studding, bolts and steel screws, bolts, nuts and washers are either cadmium plated and passivated or zinc electroplated to BS 7371 after manufacture. Do not use metal fixing components likely to deteriorate and/or cause damage through electrolytic action.

4210 SUPPORT SYSTEM - WIRE ROPE:
When proposed as an alternative support method to traditional drop rods, confirm wire rope is suitable for supporting pipelines.

4215 WIRE ROPE SUSPENSION SYSTEM:
Where used as an alternative to traditional drop rods.
Standards
- BS EN 12385-1.
- BS EN 13411-3.
- BS EN 13411-4.
- DIN 3093
- BSRIA COP 22/2002.

Material
- Stainless steel grade 316

Fastener
- Springs - stainless steel grade 302

Adjustment
- Tamperproof

Fixing
- Loop

Accessories
- Setting keys
- Span/bearer supports
- Ceiling clip fixings
- Threaded adaptors
- Anchor bolts
- Anchor for stud fixings
- Ceiling fixing kit
- Corner saddle
- Fastener décor cover

4220 SUPPORT SPACING:
Space supports as tables.

Pipe Size (mm)	Maximum Support Spacing (m)					
Nominal	Steel Pipe (Insulated)		Copper or Light Gauge Stainless Steel Pipe (Insulated)		Iron Pipe	
	horizontal	vertical	horizontal	vertical	horizontal	vertical
Up to 15	1.8	2.4	1.2	1.8	-	-
20	2.4	3.0	1.2	1.8	-	-
25	2.4	3.0	1.5	2.4	-	-
32	2.4	3.0	1.8	3.0	-	-
40	2.4	3.7	1.8	3.0	-	-
50	2.4	3.7	1.8	3.0	1.8	1.8
65	3.0	4.6	2.4	3.7	-	-

80	3.0	4.6	2.4	3.7	2.7	2.7
100	3.0	4.6	2.4	3.7	2.7	2.7
125	3.7	5.5	3.0	3.7	-	-
150	4.5	5.5	3.7	3.7	3.7	3.7
200	6.0	8.5	-	-	3.7	3.7
250	6.5	9.0	-	-	4.5	5.4
300	7.0	10.0	-	-	8.0	10.0
350	10.0	12.0	-	-	-	-
400	10.5	12.6	-	-	-	-
450	11.0	13.2	-	-	-	-
500	12.0	14.4	-	-	-	-
600	14.0	16.8	-	-	-	-

Pipe OD	Maximum Support Spacing (m) PVC or ABS Pipe Contents up to 20°C	
	Horizontal	Vertical
15	0.8	1.2
20	0.8	1.2
25	0.9	1.3
32	1.0	1.5
40	1.1	1.6
50	1.3	1.9
80	1.6	2.4
100	1.9	2.8
150	2.1	3.0
200	2.4	3.6
250	2.6	3.9
300	2.8	4.2

PIPE BORE	PE PIPE		GLASS PIPE	
(mm)	Type 32	Type 50		
nominal	horiz	horiz	horiz	horiz
up to 10	0.3	0.45	-	-
15	0.4	0.6	-	-
20	0.4	0.6	-	-
25	0.4	0.6	-	-
32	0.45	0.7	-	-
40	0.45	0.7	0.9	1.7
50	0.55	0.85	1.2	1.7
65	0.55	0.85	-	-
80	0.6	0.9	1.2	1.7
100	0.7	1.1	1.2	1.7
125	-	-	-	-
150	-	1.3	1.2	1.7
175	-	-	-	-
200	-	-	-	-
225	-	-	-	-
250	-	-	-	-
300	-	-	-	-
350	-	-	-	-
400	-	-	-	-

450	-	-	-	-
above 450	-	-	-	-

Maximum horizontal support spacing for grooved steel pipe

6.0m when jointed with flexible type mechanical joints.

10m when using flexible couplings, sleeve type.

For grooved steel and copper pipe, no individual pipe length should be left unsupported.

Vertical support spacing

Check total self-weight and pressure loading against manufacturer's recommendations when using mechanical joints or end load capable flexible couplings. Ensure adequate pipe support when using non-end load capable flexible couplings.

Space vertical support intervals for plastics pipe at not greater than twice horizontal intervals tabulated.

Space external vertical PE gas pipes in accordance with the current edition of IGEM/UP/2

Space horizontal and vertical pliable corrugated stainless steel gas pipes in accordance with the current edition of IGEM/UP/2.

Space LPG pipework in accordance with BS EN 16125.

Where multiple pipe runs of differing bores are supported from a common point, use support spacing of pipe requiring closest spacing.

Spacings given for PVC U pipe to BS EN ISO 1452 are for 20°C ambient or working temperature. Reduce spacing between supports for temperatures above 20°C. Support continuously for temperatures 60°C and above.

4231 ISOLATION AND REGULATION:

Provide valves, cocks and stop taps for isolation and/or regulation where indicated, and on:

Mains to isolate major sections of distribution.

Branch feeds to floors from risers.

The base of all risers and drops except in cases where one item of apparatus only is served which has its own local valve or stop tap.

Points of pipe connection of all items of apparatus and equipment except where the item could conveniently be isolated or regulated by valves provided for other adjacent items.

At all terminal units.

Draw-off fittings except where ranges of fittings are served by a common float, the isolator then being fitted with the float.

4241 MAINTENANCE AND RENEWAL:

Arrange pipework, valves, drains, air vents, demountable joints, supports, etc., for convenient routine maintenance and renewals. Ensure that the location of pipelines, wiring and wireways does not hinder or prevent the maintenance or removal of removable equipment such as cooling coils, filters etc.

Provide all runs with a regularly spaced pattern of demountable joints in the form of unions, flanges, etc., and also at items of equipment to facilitate disconnection.

Locate valves, drains, flanges etc. in groups.

4250 CLEANING:

Remove cement and clean off all pipework and brackets.

4260 NON-FERROUS COMPONENTS:

Thoroughly clean and degrease.

4401 PROTECTION OF UNDERGROUND PIPEWORK:

Protect buried gas pipework and other pipework where indicated, against corrosion by the application of a compatible anti-corrosive, non-cracking, non-hardening waterproof sealing tape.
Apply, after cleaning pipework, by wrapping contrawise with two layers spirally around the pipe, ensuring a 50% minimum overlap.

4411 PROTECTION OF BURIED PIPES:
Provide earth cover as follows
Water pipework
900 mm minimum; 1200 mm maximum where practicable.
Fuel oil and gas
500 mm minimum.
Under roadways
Provide minimum cover of 900 mm.
Provide a marker tape to identify buried pipe services.

4420 PROTECTION OF PIPES IN SCREEDS:
Wrap pipework with two protective tapes prior to laying.
or Sheath pipework with PVC.

4430 CORROSION PROTECTIVE TAPE:
Apply basic cotton carrier tape saturated with petroleum hydrocarbons with inert siliceous fillers. Wind tape spirally contrawise round pipework applied and overlapped to manufacturer's recommendations.

4440 MECHANICAL PROTECTIVE TAPE:
Apply Hessian based bitumenous tape over the corrosion protective tape. Wind tape spirally contrawise round pipework applied and overlapped to manufacturer's recommendations.

4480 STEELWORK GALVANIZED AFTER MANUFACTURE:
Where indicated galvanize steelwork after manufacture.

4490 NON-FERROUS COMPONENTS:
Thoroughly clean and degrease.

5000 WORKMANSHIP, STEEL PIPEWORK:

5011 WELDING GENERAL, CLASS 1:
Use skilled craftsman in possession of a current Certificate of Competence appropriate to type and class of work, issued by an approved authority. Mark each weld to identify operative. Submit specimen welds, representative of joints and conditions of site welding, for each craftsman. Test non-destructively, approximately 10% of butt weld joints and 5% of all other joints, including prefabricated works as scheduled.
Weld pipeline joints to BS 2633.
Undertake non destructive testing in accordance with BS EN ISO 17636 or BS EN ISO 17640 and BESA TR/5

5012 WELDING GENERAL, CLASS 2:
Use skilled craftsman in possession of a current Certificate of Competence appropriate to type and class of work, issued by an approved authority. Mark each weld to identify operative. Submit specimen welds, representative of joints and conditions of site welding, for each craftsman. Test non-destructively, approximately 10% of butt weld joints and 5% of all other joints, including prefabricated works as scheduled.
Weld pipeline joints to BS 2971 and to BESA Code of Practice TR/5, Welding of Carbon Steel Pipework, as appropriate.
Undertake non-destructive testing in accordance with relevant part of BS EN ISO 17636 or BS EN ISO 17640 and BESA TR/5

5020 WELDED JOINTS, STEEL PIPES:
Preparation, Making and Sealing.
Unless scheduled otherwise - arc welding, conforming to BS 2633 (Class I) or BS 2971 (Class II) appropriate to system temperature and pressure. Use arc welding process on piping greater than 100mm.

5030 PAINTING WELDED JOINTS, STEEL PIPES:

Unless pipework is being prepared for galvanizing after manufacture, wire brush and paint all welds with red oxide paint when welds are complete.

5040 FLANGED JOINTS, STEEL PIPES:

Welded Flanges

Weld neck and bore of 'slip on' flange.

Butt weld neck of welding neck flange.

Screwed Flanges

Apply jointing materials. Screw on flange and expand tube into flange with roller expander where necessary.

Preparation

Ensure that flange mating faces are parallel; flange peripheries are flush with each other; and bolt holes are correctly aligned.

Making and Sealing

Insert jointing between flange mating faces. Pull up joint equally all round.

5050 SCREWED JOINTS, STEEL PIPES:

Preparation

Ensure that plain ends are cut square. Reamer out bore at plain ends. Screw plain ends, taper thread.

Making and Sealing

Coat male pipe threads with jointing compound and hemp, or PTFE tape on small sizes. Immediately after applying coating, connect with female end of socket or fitting, and tighten ensuring that coating does not intrude into pipe. Leave joint clean.

5060 MECHANICAL JOINTS, GROVED STEEL AND STAINLESS STEEL PIPES:

Preparation

Ensure installers receive training from manufacturer on correct installation technique, and correct and safe use of pipe grooving tool by a factory trained manufacturer's representative. The grooving tool must be manufactured by the grooved coupling manufacturer. Ensure that cut ends are square, free of bumps, dents and score marks and that pipe outside diameter is within mechanical joint manufacturer's tolerances. Form groove in accordance with manufacturer's recommendations and to manufacturer's groove diameter tolerances. Ensure that the manufacturer supplies a grooved measuring tape to be able to check the groove is in tolerance. Manufacturer must provide certification to anyone grooving onsite or in a fabrication shop to show the correct training has been provided. Assemble joint in accordance with manufacturer's instructions.

Making and Sealing

Ensure gasket material is suitable for service. For standard couplings thoroughly lubricate gasket, externally and internally, using manufacturer's recommended lubricant. Stretch gasket over one pipe end and bring pipe ends together. Slide gasket into central position over both pipe ends. Position joint half housings over gasket and insert bolts and nuts. Joints should not require any torque to show visual bolt pad to pad connection, if alternative joints are to be proposed that require torque this must be notified at the time of tender for approval. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.

Earth continuity

Full earth continuity shall be achieved by both rigid and flexible couplings. If the manufacturer's coupling selected cannot achieve this, install proprietary earth continuity clips to ensure compliance with IET regulations at each joint.

Installation-ready couplings

Do not dismantle the coupling. Lubricate inner sealing lips of gasket using manufacturer's recommended lubricant. Assemble the joint by inserting the grooved pipe ends into each opening of the coupling until the ends make contact with the gasket center leg. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.

5081 PRESS FITTING AND PUSH FITTING JOINTS:

Make press fitting and push fitting joints in accordance with manufacturer's recommendations. Ensure all fittings are electrically continuous when the jointing process is complete. Ensure all on site operatives receive adequate training from the system manufacturers prior to commencing work on site and are issued with an appropriate ID card to validate this training

Debur inside and outside of pipe using the manufacturer' proprietary de-burer where available. Using a manufacturers insertion depth gauge / proprietary tool mark the insertion distance on the pipe before making a joint. On completion of a joint mark with a paint check mark.
Comply with IGEM/UP/2 edition 3 Appendix 8 pressed fittings jointing procedure when used on natural gas pipework.

5090 STEEL PIPEWORK PAINTING:

Remove scale, rust or temporary protective coating by chipping, wire brushing or use of approved solvents and paint with one coat of red oxide primer, as work proceeds.

5091 STEELWORK PAINTING:

Prepare supports, bearers and other uncovered steelwork as steel pipework.
Where not exposed, paint with one coat zinc chromate or red oxide primer.

5100 COMPRESSION JOINTS, STAINLESS STEEL PIPES:

Use BS EN 1254 – 2 Type 'A' fittings.

Preparation

Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool.

Making and Sealing

In accordance with fitting manufacturer's instructions.

5110 CAPILLARY JOINTS, STAINLESS STEEL PIPES:

Preparation

Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size and clean plain ends.

Making and sealing

Use a suitable phosphoric acid based flux to BS 5245. Make joint in accordance with manufacturer's instructions. Clean off traces of flux when joint is completed. Use end fed fittings only where indicated, using silver brazing alloy and flux to manufacturer's recommendations.

5120 BRAZED JOINTS, STAINLESS STEEL JOINTS:

Preparation

Prepare for brazing in accordance with BS EN 14324

Making and Sealing

Use flame heat and make in accordance with BS EN 14324 Use nickel bearing zinc free filler metals.

6000 WORKMANSHIP, COPPER PIPEWORK:

6010 WELDING GENERAL:

Use skilled craftsman in possession of a current Certificate of Competence appropriate to type and class of work, issued by an approved authority. Mark each weld to identify operative. Submit specimen welds, representative of joints and conditions of site welding, for each craftsman, test non-destructively, approximately 10% of buttweld joints and 5% of all other joints.

6030 COMPRESSION JOINTS, COPPER PIPES, LIGHT GAUGE:

Preparation for fittings to BS EN 1254 – 2

Type “A” fitting

Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool or fine sandpaper

Type `B' fitting

Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool or fine sandpaper, then comply with manufacturer's instructions.

Making and Sealing

In accordance with fitting manufacturer's instructions.

6040 CAPILLARY JOINTS, COPPER PIPES, LIGHT GAUGE:

Preparation

Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool.

Making and sealing

Use specified flux ensuring no excess material used. Make joint in accordance with manufacturer's instructions. Clean off traces of flux when joint is completed.

6050 BRAZED JOINTS, COPPER / COPPER ALLOY PIPES:

Preparation

Prepare for brazing in accordance with BS EN 14324 Use manufactured fittings not subject to dezincification and suitable for application.

Making and Sealing

Use flame heat and make in accordance with BS EN 14324 Use silver brazing filler alloy suitable for application.

6060 ANCHORS, COPPER PIPES, FLANGES:

Provide anchors constructed by fitting two flanges to copper female adapters in pipe run at anchor point. Bolt together through an interposed mild steel channel section attached to or grouted into building structure.
or
Anchor pipework using saddle clamps to mild steel channel section attached to or built into building structure.

6070 MECHANICAL JOINTS, GROVED COPPER PIPES:

Preparation

Ensure installers receive training from manufacturer on correct installation technique, and correct and safe use of pipe grooving tool by a factory trained manufacturer's representative. The grooving tool must be manufactured by the grooved coupling manufacturer. Ensure that cut ends are square, free of bumps, dents and score marks and that pipe outside diameter is within mechanical joint manufacturer's tolerances. Form groove in accordance with manufacturer's recommendations and to manufacturer's groove diameter tolerances. Ensure that the manufacturer supplies a grooved measuring tape to be able to check the groove is in tolerance. Manufacturer must provide certification to anyone grooving onsite or in a fabrication shop to show the correct training has been provided. Assemble joint in accordance with manufacturer's instructions.

Making and Sealing

Ensure gasket material is suitable for service. For standard couplings thoroughly lubricate gasket, externally and internally, using manufacturer's recommended lubricant. Stretch gasket over one pipe end and bring pipe ends together. Slide gasket into central position over both pipe ends. Position joint half housings over gasket and insert bolts and nuts. Joints should not require any torque to show visual bolt pad to pad connection, if alternative joints are to be proposed that require torque this must be notified at the time of tender for approval. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.

Earth continuity

Full earth continuity shall be achieved by both rigid and flexible couplings. If the manufacturer's coupling selected cannot achieve this, install proprietary earth continuity clips to ensure compliance with IET regulations at each joint.

6081 PRESS FITTING AND PUSH FITTING SYSTEMS:

Make press fitting and push fitting joints in accordance with manufacturer's recommendations. Ensure all fittings are electrically continuous when the jointing process is complete. Ensure all on site operatives receive adequate training from the system manufacturers prior to commencing work on site and are issued with an appropriate ID card to validate this training

Debur inside and outside of pipe using the manufacturer' proprietary de-burer where available. Using a manufacturers insertion depth gauge / proprietary tool mark the insertion distance on the pipe before making a joint. On completion of a joint mark with a paint check mark.

Comply with IGEM/UP/2 edition 3 Appendix 8 pressed fittings jointing procedure when used on natural gas pipework.

7000 WORKMANSHIP, CAST/DUCTILE IRON:

7010 FLANGED JOINTS, CAST IRON/DUCTILE IRON PIPES:

Preparation

Ensure that flange mating faces are parallel, flange peripheries are flush with each other and bolt holes are correctly aligned.

Making and Sealing

Coat both sides of joint ring with jointing compound to BS 6956 Part 5 or BS EN 751 - 2. Insert joint ring between flange mating faces. Pull up joint with bolts, nuts and washers, ensuring that excess compound does not intrude into the pipe. Leave joint clean.

7020 CAULKED JOINTS, CAST IRON/SPUN CAST IRON PIPES:

Preparation

Ensure plain ends are cut square.

Making and sealing

Caulk socket with yarn, fill socket with molten lead, allow to cool and caulk home. Ensure bore of pipe is not obstructed.

Finish off lead joint to a neat fillet at the mouth of the socket.

7030 FLEXIBLE JOINTS, CAST IRON PIPES:

Preparation

Ensure that cut ends are square. Form groove to manufacturer's detail. Assemble joint in accordance with manufacturer's instructions.

Making and Sealing

Ensure joint ring is suitable for service. Thoroughly lubricate joint ring. Slip ring over pipe end and bring ends together. Slide ring into central position over both pipe ends. Position metal half housings over joint ring and insert bolts and nuts. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.

8000 WORKMANSHIP, PLASTICS PIPES:

Comply with the requirements of BESA TR11.

8005 THERMOPLASTIC PIPING SYSTEMS FOR SOIL AND WASTE DISCHARGE:

For soil and waste discharge piping inside buildings comply with recommendations in PD CEN/TR 13801 and general installation practice given in BS EN 12056 Parts 1-5.

8006 THERMOPLASTIC PIPING SYSTEMS FOR HOT AND COLD WATER AND HEATING:

Install polybutylene and cross linked polyethylene pipes and associated fittings to all parts of BS 7291 in accordance with BS 5955-8 and the manufacturer's recommendations.

8010 SOLVENT WELDED JOINTS, PVC PIPES:

Use solvent welded joints generally, ring seal joints at expansion joints and elsewhere as necessary.

Preparation

Ensure that plain ends are cut square. Reamer out bore at plain ends. Clean plain ends with solvent cleaner.

Making and Sealing

In accordance with fitting manufacturer's instructions.

8020 FUSION JOINTS, POLYETHYLENE PIPES:

Preparation

Square cut plain ends. Form pipe ends for socket type joints.

Making and Sealing

In accordance with fitting manufacturer's instructions.

Carry out butt fusion jointing of pipes and fittings in accordance with the manufacturer’s instructions.

8030 MECHANICAL FITTINGS FOR POLYETHYLENE PIPE:

Preparation

Ensure that cut ends are square. Check wall thickness/pressure rating of fitting.

Making and sealing

Ensure correct gasket type is used for service (e.g. water or gas). Assemble fitting in accordance with manufacturer's instructions.

8040 ANCHORS, PVC PIPES

Clamp pipework to mild steel channel section attached to or grouted into building structure, using PVC coated overstraps, or clamps and with a polypropylene strip between pipe and mild steel section.

8060 COMPRESSION FITTINGS ON MULTI-LAYER PIPES:

Carry out the installation of compression fittings on multi-layer pipe in accordance with manufacturer's recommendations.

9000 WORKMANSHIP (PROTECTION / MISC)

9010 FLEXIBLE COUPLINGS AND FLANGE ADAPTERS, SLEEVE TYPE:

Preparation

Ensure that cut ends are square and free of bumps, dents and score marks and are within manufacturer's tolerances.

Making and sealing

Ensure gasket is suitable for service. Thoroughly lubricate gasket using manufacturer's recommended lubricant. Assemble coupling in accordance with manufacturer's instructions.

For non-end load capable couplings, ensure that adequate pipe anchorage is provided to prevent pipe disengagement.

9021 STEAM AND CONDENSATE MAINS:

Steam mains

Whenever possible install with a fall not less than 1:100 in the direction of steam flow. In circumstances where this is not practical lower falls may be acceptable but no lower than 1:250.

Where a steam main has to rise in the direction of flow, install with a slope not less than 1:40.

Condensate return lines

Install discharge lines from trap sets with a fall of 1:70.

Lift pumped condensate from receivers immediately after the pump and wherever possible size and install the return pipe with a gravity fall to the end of the line ensuring the fall is adequate to overcome frictional resistance of the pipe. Install a vacuum breaker at the top of the lift and install automatic air vents whenever the pipe has to drop/rise to avoid clashing with other services/building structure.

Take steam connections to plant and equipment from the top of the steam main.

Connect condensate discharge from trap sets into the top of the condensate main.

Do not use trap sets to lift condensate on equipment with automatic control valves to avoid stall in the heat exchanger.

Install strainers on their sides when they are part of a steam line to avoid water hammer.

Use thermodynamic traps on pipelines which may be subject to freezing conditions.

On steam mains, provide drain points comprising drain pocket and trap set trap discharging into condensate mains

Drain pocket minimum dimensions

Pocket diameter - mains diameter for mains up to 100mm; 100m diameter for main sizes 125mm - 200mm; for mains 250 diameter and above - 0.5 x mains diameter.

Depth - for mains up to 100mm diameter - 100mm deep; for main sizes 125mm - 200mm diameter - 150mm deep; for mains 250 diameter and above - depth to be equal to mains diameter.

Locate drain points at all low points on steam mains, at intervals not greater than 40m (but where possible at 30m intervals) and immediately before all automatic control valves on steam mains.

9030 PROTECTION OF UNDERGROUND PIPEWORK:

Where indicated or scheduled protect against corrosion by the application of a compatible anti-corrosive, non- cracking, non-hardening waterproof sealing tape.

Apply, after cleaning pipework, by wrapping contrawise with two layers spirally around the pipe, ensuring a 50% minimum overlap.

9040 PROTECTION OF BURIED PIPES:

Provide earth cover as follows

Water 750mm minimum (900 -1200mm maximum where practical)

Gas 600mm (footway), 750mm (verge), 750mm (carriageway).

Fuel oil 900mm

Install in accordance with latest revision of NJUG Guides:

Utilities Guidelines on Positioning and Colour Coding of Apparatus

Guidelines for the Planning, Installation and Maintenance of Utility Services in Proximity to Trees

Install PVC marker tapes to all trenches as detailed below.
All services to be 900mm under roadways.
Provide a marker tape to identify buried pipe services as indicated.

9050 PROTECTION OF PIPES IN SCREEDS:

Wrap pipework with two protective tapes prior to laying or
Sheath copper pipework with PVC or LDPE.

9060 INSTALLATION OF THERMALLY INSULATED UNDERGROUND PIPELINES:

Install pre-insulated bonded steel pipelines to BS EN 253, BS EN 448, BS EN 488 and BS EN 489-1 or BS EN 15698-1 (pipe assemblies) and BS EN 15698-2 (fitting and valve assembles) for twin pipe systems in accordance with manufacturer's instructions and BS EN 13941-2.

Install pre-insulated bonded flexible pipe system to BS EN 15632-1 and BS EN 15632-2, with plastic service pipes in accordance with manufacturer's instructions.

Install pre-insulated non bonded flexible pipe system with plastic service pipes to BS EN 15632-1 and BS EN 15632-3 in accordance with manufacturer's instructions.

Install pre-insulated bonded flexible pipe system with metal service pipes to BS EN 15632-1 and BS EN 15632-4 in accordance with manufacturer's instructions.

9100 CORROSION PROTECTIVE TAPE:

Apply basic cotton carrier tape saturated with petroleum hydrocarbons with inert siliceous fillers. Wind tape spirally contra wise round pipework applied and overlapped to manufacturer's recommendations.

9110 MECHANICAL PROTECTIVE TAPE:

Apply Hessian based bituminous tape over the corrosion protective tape. Wind tape spirally contra wise round pipework applied and overlapped to manufacturer's recommendations.

9120A STEELWORK PAINTING:

Prepare supports, bearers and other uncovered steelwork as steel pipework.
Where not exposed, paint with one coat zinc chromate red oxide primer.
Where exposed, paint all cut ends of hangars, etc with two coats of zinc rich primer. Cut all hangar rods close to backnuts and paint as hangars.

10000 Based on NES Y10 TEXT Dec 19

Y11 – Pipeline Ancillaries

1001 **GENERAL [based on NES 211.010]**

The tender drawings show the design intent and do not necessarily show all facilities for filling, draining, flushing, cleaning, draining and chemical cleaning of the water systems.

The Contractor shall include in the installation all necessary facilities, including sample coolers (if required) , to enable a Specialist to successfully fill, flush, clean, and chemically treat the systems listed in schedule Y25 in accordance with the latest edition of BSRIA Guide BG29 “Pre-commissioning cleaning of pipework systems.

Where 2 port control valves and PICV’s are installed and the a orifice of the control valve is too small to allow adequate flow for back flushing a drain point shall be located between the two-port valve and the coil connection.

The Contractor shall review all designs to ensure that systems are commissionable in accordance with the CIBSE commissioning code W and BSRIA Guide BG2/2010 as detailed in Y51. If additional facilities are required the Contractor shall advise the designer prior to commencing work on site.

All fittings, pipe joints and flanges PN rating shall be suitable for hydraulic test pressure of the system (ie minimum of 1.5 times the maximum operating pressure).

For applicable valves comply with BS EN 16668 for all essential safety requirements of the Pressure Equipment (Safety) Regulations 2016. Valves excluded from conformance to this standard in the Regulations shall meet "sound engineering practice" by conformity to the relevant product standard.

Face to face and centre to face dimension of PN and Class designated flanged metal valves to be in accordance with BS EN 558.

Marking

In accordance with BS EN 19 or BS ISO 5209 for general purpose industrial metallic valves

Plastic valves to be marked in accordance with the appropriate valve standard.

Wall thickness of valve bodies, bonnets and covers to be determined in accordance with the appropriate part of BS EN 12516

In addition to the particular valve type standard, valves to be used in, or connected to, water supply pipe systems, above or below ground carrying water intended for human consumption to comply with the relevant parts of BS EN 1074 and BS 5163 as appropriate to the application.

BS EN 1074-1 - General requirements
BS EN 1074-2 - Isolating valves
BS EN 1074-3 - Check valves
BS EN 1074-4 - Air valves
BS EN 1074-5 - Control valves
BS EN 1074-6 – Hydrants

Valves and components of valves specified are as defined in BS EN 736-1 (types of valves) and BS EN 736-2 (components).

1010 **SAFETY DEVICES AND RELIEF VALVES - SELF OPERATED - APPLICATION:**

Safety

To discharge with rapid opening action to prevent predetermined safe pressure being exceeded.

Relief

To discharge with opening action proportional to increase in pressure above set pressure.

Select, supply and install safety devices in accordance with relevant parts of BS EN ISO 4126 to suit the project particular requirements.

1020 **EXPOSED VALVES:**

Fit easy-clean covers over glands and bonnets to small copper alloy valves exposed in areas other than plant rooms. Fit thermoplastic valve wheels. Fit dust caps to lockshield valves.

1030 **TESTING [based on NES 211.010]:**

Ensure that valves and cocks are pressure tested at manufacturer's works, in accordance with specific requirements of the valve product or performance standard. Pressure test valves in accordance with BS EN 12266-1 or BS ISO 5208. Undertake supplementary tests as necessary in accordance with BS EN 12266-2.

Pressure test thermoplastic valves at manufacturer's works, in accordance with BS ISO 9393-1 in conjunction with given specific requirements of the valve product or performance standard.

For valves used for volatile air pollutants and hazardous fluids, test for external leakage in accordance with relevant parts of BS EN ISO 15848.

1040 VALVE REMOVAL

All valves used on water services installations shall be provided with means of disconnection. Screwed or capillary valves shall be fitted with unions either side. Compression ended valves shall only be used for final isolation or where easily accessible.

2000 PRODUCTS/MATERIALS

2005 VALVE ENDS

Ends of valves shall suit the pipelines into which they are installed.

2007 STOP VALVES - SLUICE TYPE TO BS 5163:

Valve type (as BS) - A
Application – Waterworks purposes
Ends
Flanged to BS EN 1092
Seat
Metal seated.
Stem seal
Stuffing box and gland.
Operation
Handwheel.
Materials
Manufacturer's standard.
or As otherwise indicated.
Options
Stem cap.

2015 STOP VALVES (STOP COCK) TO BS EN 1213 FOR POTABLE WATER SUPPLIES:

Material - copper alloy.
Flow rate class
VA (straight and angle pattern stop valves).
VB (oblique pattern stop valves).
End connections
Compression to BS EN 1254-2. or Compression to BS EN 1254-3 or Capillary to BS EN 1254-1. or Threaded to Relevant parts of BS EN 10226 .

2016 MANUALLY OPERATED VALVES FOR GAS:

Comply with the requirements of IGEM/UP/2 edition 3 for the selection and installation of manual valves for pipe section / plant isolation, buried below ground, by-pass and AECV applications in accordance with the following standards.

BS EN 331 – ball and taper plug valves.
BS EN 593 – butterfly valves
BS EN 1984 – steel gate valves
BS EN ISO 15761 – steel gate, globe and check valves not exceeding 100mm NB
BS EN 12266 parts 1&2 – testing and test procedures for valves
BS EN 13774 – gas valves for distribution systems up to 16 bar

Threaded to Relevant parts of BS EN 10226 or Flanged to BS EN 1092-1

2021 STOP VALVES – COPPER ALLOY GATE TYPE TO BS EN 12288:

Gate valve type
Solid or split wedge
Ends
Threaded to Relevant parts of BS EN 10226 or Flanged to BS EN 1092
Stem
Inside screw non rising stem or outside screw non rising stem.
Trim material
Suitable for potable water supply.
Operation
Handwheel
Options

Position indicator.
Locking device.

2031 STOP VALVES – CAST IRON GATE TYPE TO BS EN 1171:

Valve type
Solid or split wedge.
Inside screw stem (non-rising).
Stem sealing
Stuffing box and gland.
Ends
Flanged to BS EN 1092-2. PN as indicated
Body and bonnet material
Grey cast iron or SG iron as scheduled or to suit the pressure/temperature application
Trim category
Copper alloy faced.
Operation
Handwheel.
Suitable for use with potable water.
Options
Position Indicator.
Locking device.

2061 PARALLEL SLIDE VALVES TO BS EN 1984:

Material – Steel
Application – Steam and HTHW
Ends - Flanged BS EN 1092-2 or butt-weld with dimensions of ends to BS EN 12627 as indicated.
Stem - Rising stem.
Valve faces - Stainless steel disc and seat.

2081 STOP VALVES - BALL TYPE:

Standards / application / material
Potable water - copper alloy to BS EN 13828, PN 10 and distribution temperature of 65 °C with occasional excursions up to 90 °C permitted for a period of 1 hour maximum.
General purpose heating, cooling and other applications - copper alloy to BS EN 13547.
Industrial and high temperature / pressure applications - steel ball valves to BS EN 1983
Steam and high temperature / pressure applications - carbon steel to BS ISO 7121 - reference Y11.2161.
Gas - to BS EN 331.
Ends - Threaded to Relevant parts of BS EN 10226 or grooved or flanged as scheduled.
Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals.
Anti-blowout stem.
Operation - lever operated or screw driver operated or key operated.
For hot and cold water applications to BS EN 13828, incorporate a flow regulator within the isolation valve where the static pressure exceeds 1 bar.

2085z SERVICING VALVES TO BS 6675

Material - copper alloy.
End connections
Compression to BS EN 1254-2 or Compression to BS EN 1254-3 or Capillary to BS EN 1254-1 or threaded to Relevant parts of BS EN 10226 .
Operation – as indicated on drawings.

2090z STOP VALVES - BUTTERFLY TYPE TO BS EN 593:

Construction
Provide controlled elastomer compression on flange faces.
Semi-lugged, l wafer type design or grooved type capable of dead end service and bi-directional service, with disc offset from stem. Grooves for 350mm and larger to be wedge shaped, for example, Victaulic advanced groove system (AGS).
For installation between flanged pipework connections, body to suit BS EN 1092.
Provide lever-operated valves with long body neck for lagging clearance.
Seat - bonded. pressure responsive elastomer in sizes up to 300mm, disc mounted seal for 350mm and larger.
Materials

Ductile iron or Carbon Steel or stainless steel body to suit application and operating pressure / temperature conditions.
Stainless steel shaft.
Disc material suitable for service fluid and operating temperature.
EPDM seat
Body lining material suitable for service fluid and operating temperature. For potable services the linings shall be arranged such that the fluid is not in contact with any ferrous parts.

Operation

Lever and graduated notch plate up to 150mm. Gear box operator above 150mm. Unless otherwise indicated.

2121 STOP VALVES TO BS 5433

Application

Underground stop valves for water services

Material

Bronze or DZR copper alloy body threaded to relevant parts of BS EN 10226
Washer material suitable for service fluid and operating temperature Material

2127 THERMOPLASTIC VALVES (NES 211.032 / Y11.2126)

Standards

BS EN 15389 for performance characteristics
Relevant parts of BS ISO 9393 for pressure testing
BS EN ISO 16135 for the design and manufacture of ball valves
BS EN ISO 16136 for the design and manufacture of butterfly valves
BS EN ISO 16137 for the design and manufacture of check valves
BS EN ISO 16138 for the design and manufacture of diaphragm valves
BS EN ISO 16139 for the design and manufacture of gate valves
BS EN ISO 21787 for the design and manufacture of globe valves
For water supply and drainage to BS EN 12201-4
For gas supply to BS EN 1555-4

PN to suit system maximum working pressure.
WRAS approved for water services applications.

2130 STOP VALVES - LUBRICATED PLUG COCK TYPE TO BS 5158:

Materials

Cast Iron

Pattern

Short or regular.

Ends

Flanged to BS EN 1092-1 or BS EN 1092 -2 as indicated or screwed to Relevant parts of BS EN 10226

Body seat

Tapered or Parallel, or Plug fitted with injection facility for lubrication or sealing compound.

Operation

Wrench, but with wheel and gearbox where indicated.

Options

Provide manufacturer's charge of lubrication/ sealant suitable for service fluid and operating temperature.

2161 STOP VALVES - BALL TYPE TO BS ISO 7121:

Material

Carbon Steel or stainless steel body as scheduled

Pattern

Full bore.

Ends - threaded to relevant parts of BS EN 10226 unless detailed otherwise elsewhere.
(Socket weld ends to be to BS ISO 7121 or BS EN 12627 & butt welding ends to BS ISO 7121).

Operation

Wrench.

Trim material

Manufacturer's standard.

Options
Wrench.

2170 STOP VALVES - DIAPHRAGM TYPE TO BS EN 13397:
Pattern - Weir.
Ends -Flanged to BS EN 1092-1 or BS EN 1092-2 or BS EN 1092-4 PN as indicated or Threaded to Relevant parts of BS EN 10226
Materials
Suitable for service fluid and operating temperature.
Operation
Hand wheel.
Options
Sealed bonnet.

2210 REGULATING VALVES - BUTTERFLY TYPE:
Standard - BS EN 593.
Construction
Provide controlled elastomer compression on flange faces.
Fully lugged wafer type design or grooved type capable of dead end service and bi-directional service, with disc offset from stem.
For installation between flanged pipework
Body flanged to suit BS EN 1092
Provide lever and gear operated valves with long body neck for lagging clearance.
Seat
Bonded.
Materials
Cast iron body.
Stainless steel shaft.
Aluminium bronze disc.
Disc material suitable for service fluid and operating temperature.
EPDM seat.
Body lining material suitable for service fluid and operating temperature.
Operation
Infinitely variable setting with travel stops and position indicator.
Gear box operation.

2221 DOUBLE REGULATING VALVES - GLOBE TYPE TO BS 7350:
Series (as BS) - B.
Material
Copper Alloy to BS 5154
or cast iron to BS EN 13789 as scheduled
Pattern
Oblique or Y. Flanged to BS EN 1092 – 2 or BS EN 1092-3 or screwed to Relevant parts of BS EN 10226 or grooved
Stem
Inside screw rising stem.
or Outside screw rising stem.
Trim material
Suitable for potable water supply.
Operation
Lockshield.
Options
Regulating locking device to
Provide double regulating facility.

2230A FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 3, COPPER ALLOY:
BS 7350, section 3.2 - type 3
A fixed orifice either integral with or as a fixed orifice fitting close coupled to a double regulating globe valve.
Ends
Threaded to Relevant parts of BS EN 10226 or flanged to BS EN 1092-2 to match pipework as indicated.

Material

Double regulating globe valve, bronze or DZR copper alloy to BS 5154 series B and close coupled fixed orifice fitting to BS 7350 table 6.

Options

Independent means for positive isolation on pressure tapping or adapter.

2230C FLOW MEASUREMENT DEVICE TO BS 7350 CAST IRON, TYPE 3:

BS 7350, section 3.2 - type 3

A fixed orifice either integral with or as a fixed orifice fitting close coupled to a double regulating globe or butterfly valve.

Ends - Flanged to BS EN 1092-2.

Material

Double regulating globe valve, cast iron to BS EN 13789 and close coupled fixed orifice fitting to BS 7350, table 6.

Options

Independent means for positive isolation on pressure tapping or adapter.

2240 ORIFICE PLATE:

Material

Stainless steel.

Carrier ring to fit inside bolt circle of flange.

or Carrier ring full faced for installation between copper alloy flanges.

Pressure tappings with self-sealing test plugs, suitable for operating conditions, for connection to manometer to provide measuring facility

2241 TERMINAL UNIT MANIFOLD COMMISSIONING MODULES:

A multi terminal commissioning system for controlling up to 6 terminal units served by either 15mm or 20mm flow measuring stations / pipework. For duties refer to drawings and terminal unit schedules.
All components to be assembled and installed in an insulated painted galvanised sheet steel box having a minimum thickness of 1.2mm incorporating handles, a clamped lid for access and external hanging points. Insulation to be a minimum thickness of 20mm and ensure the box is completely vapour sealed.
Modules are to incorporate a flushing bypass, isolation valves, and strainer with integral drain cock, pressure test points, flow isolating valves and return flow measuring / regulation valves as clause 2230A.
When used on variable volume systems an adjustable differential pressure control valve or PICV shall also be installed within the box, as indicted on the drawings.
Connections to flow & return pipes are to be BSP Threaded Female and accessible on the outside of the box to prevent disturbing the insulation.
Each module to be supplied with an identification label, identifying each manifold with flow/return designation, terminal numbers and flow rates.

2260A RADIATOR VALVES TO BS 2767

Type - Use type 4 or type 10 as required to meet system temperature and pressure

Material - Bronze or DZR copper alloy body.

Pattern - Angle or straight to suit application.

Pipework Connections - Straight

Threaded to Relevant parts of BS EN 10226
or compression to BS EN 1254-2 to suit pipework as indicated.

Angle

Threaded to Relevant parts of BS EN 10226 with one end internal and other end external with union nut and tail pipe; or compression joint to BS EN 1254-2 one end and other end externally threaded to BS 21 with union nut and tail pipe to suit pipework as indicated.

Connections

Fit wheel valves on flow connections to radiators, and other heat emitters, without thermostatic radiator valves. Fit lockshield valves on return connections.

2270 THERMOSTATIC RADIATOR VALVES:

Standard

BS EN 215 for requirements, dimensions and testing of valves in wet central heating systems up to 120°C and 10 bar.

Materials and connections as radiator valves.
Pattern - Angle or straight to suit application, valves to be tamper proof.
Ancillaries
Position indicator.
Locking device.
Temperature sensor
Unless scheduled otherwise:
Sensor head to be integral with an alpha/numeric set point indicator and complete with tamperproof / locking facility
or Remote sensor with an integral alpha/numeric/temperature set-point indicator; integral locking facility, and capillary connections between sensor and valve, or remote sensor incorporating the selector as indicated on the drawings.

2290A FLOAT OPERATED VALVES, BALANCED EQUILIBRIUM:
Bronze or DZR copper alloy body.
Inlet
Threaded to Relevant parts of BS EN 10226 or flanged to BS EN 1092 as indicated.
Spindle and head effectively guided and arranged with stops to engage with valve body and prevent over travel. Linkage fulcrum adjustable relative to vertical plane, securely locked to body tapping when set. Screwed plug from access cover.
Float and lever arm.
Spun copper float, halves brazed or welded together, with centre sleeve connecting to lever arm.
For feed and expansion application use long arm type arranged to close when tank contains 150mm depth.
WRAS approved.

2300z FLOAT OPERATED VALVES - DELAYED ACTION TYPE:
Incorporating
: Float operated valve.
: Canister - copper.
: Secondary float - gunmetal.
: Support bracket - galvanized steel.

2320z SWING CHECK VALVES TO BS 5154
Material
Copper Alloy
Series B; horizontal pattern.
Ends
Threaded to relevant parts of BS EN 10226 or flanged to BS EN 1092 to suit pipework as indicated.
Trim material - Manufacturer's standard.
To be suitable for potable water where required

2330z SWING CHECK VALVES TO BS EN 16767
Type – As defined in BS EN 736-1
Material
Cast iron unless scheduled otherwise
Pattern - Straight pattern, horizontal.
Valve face - Copper or nickel alloy.
Ends - Flanged to BS EN 1092-2 or grooved.
Material - Manufacturer's standard.
To be suitable for potable water where required.

2371 CHECK VALVES GLOBE STOP AND CHECK TYPE:
Standard - Steel - BS EN 13709.
Pattern - Straight or Angle as indicated.
Ends -Flanged to BS EN 1092-1 PN to suit system operating temperature / pressure.
Materials - Manufacturer's standard to suit fluid and operating conditions.

2385 DEVICES TO PREVENT CONTAMINATION OF WATER BY BACKFLOW:
BS EN 13959 - check valves.
BS EN 14451 - terminal anti-vacuum valves.

BS EN 14451 - in-line anti-vacuum valves.
BS EN 14451 -combined check and anti-vacuum valves.
WRAS approval.
Ends Compression connections to BS EN 1254-2 or Threaded to Relevant parts of BS EN 10226

2390A COMBINED CHECK AND ANTI-VACUUM TYPE ANTI BACK SIPHONAGE VALVES:

Bronze or DZR copper alloy body assembly with compression connections to BS EN 1254-2. or threaded to relevant parts of BS EN 10226 (horizontal or vertical)
WRAS approval
Pattern : In-line pattern or side inlet bottom outlet or bottom inlet side outlet as indicated.
Components

Stainless steel domed air inlet. Non-return valve with plastic body, rubber actuator and stainless steel to plastic seal.

2391A HOSE UNION ANTI-VACUUM TYPE ANTI BACK SIPHONAGE VALVES:

Bronze or DZR copper alloy body assembly with fittings to BS EN ISO 228-1.
Pattern - In line pattern.
Sizes - DN15 to DN25.
WRAS Approval

2395A VERIFIABLE BACKFLOW PREVENTER WITH REDUCED PRESSURE ZONE (RPZ) VALVE GENERAL REQUIREMENTS:

Provide an application to the local water supplier using the WRAS “RPZ Valve Assembly - Application for Installation” form.
Obtain Water Supplier agreement that a Type BA device is a suitable means of backflow protection in the water supply system under consideration.
Test methods and maintenance regimes shall be in accordance with the Water Suppliers requirements and any failure to comply may result in termination of supply or removal of the device. These maintenance requirements must be detailed within the project Operation & Maintenance documentation.
The fitting must be included in the WRAS “Water Fittings and Materials Directory” and satisfy the requirements of the Regulations.
The installer must obtain formal Water Supplier agreement that a Type BA device is a suitable means of backflow protection in the plumbing system under consideration before installation.
Confirm that any Type BA device installed provides protection against back pressure and back siphonage at the point of use from fluids up to and including Category 4 as defined in:

England and Wales - The Water Supply (Water Fittings) Regulations 1999, the Water Act 2014 and the Construction Products Regulations 2013.
Scotland - The Water Supply (Water Fittings) Byelaws 2014.
Northern Ireland - The Water Supply (Water Fittings) Regulations (Northern Ireland) 2009.

Comply with the stipulations and requirements set out in WRAS Approved installation method Document AIM-08-1.

2395B VERIFIABLE BACKFLOW PREVENTER WITH REDUCED PRESSURE ZONE (RPZ) VALVE INSTALLATION:

The Type BA device shall not be installed in a place or position which is:

Liable to flooding
Above electrical equipment
Exposed to freezing - unless measures are taken to prevent the assembly from freezing

The assembly shall be:
Installed horizontally with the relief valve discharging downwards. Inline strainers shall be fitted downstream of the inlet isolating valve and immediately upstream of the device - to prevent fouling of elements of the assembly.
The valve shall be Installed not less than 300mm above ground or floor level or the base of any cabinet to the underside of the exit port of the relief valve and no more than 1500mm above ground or floor level. An air break shall be provided between the relief outlet port and the top of the allied tundish.
Following installation the assembly shall be flushed and disinfected in accordance with BS EN 806-4 and complimentary guidance in BS 8558.
Following flushing and prior to commissioning and site test, the assembly shall be checked by the installer to ensure that the relief valve functions correctly - in accordance with the guidelines in WRAS Approved installation method Document AIM-08-1.

2395C VERIFIABLE BACKFLOW PREVENTER WITH REDUCED PRESSURE ZONE (RPZ) VALVE ON SITE INSPECTION AND TESTING:

Site testing must only be carried out by an accredited tester approved by the Water Supplier.
Testing shall be carried out at intervals not exceeding 12 months.
Test data during the commissioning of the assembly and at subsequent intervals shall be entered on the "RPZ Valve Test Report Form" produced by the WRAS.
The inspections and testing shall be in accordance with WRAS Approved installation method Document AIM-08-1.
On completion of site tests, a certificate must be completed by the tester in accordance with WRAS Guidance Note and copies submitted to the water supplier and the person responsible for the device. Copies shall be included in the Operation and Maintenance Manuals, including interval periods for subsequent testing.

2395D VERIFIABLE BACKFLOW PREVENTER WITH REDUCED PRESSURE ZONE (RPZ) VALVE RECORD OF INSTALLATION AND TEST DATA:

Provide records for each assembly.
In general, the record shall indicate the following:

- Precise location of the assembly
- Purpose of the assembly
- Data pertaining to prescribed tests
- Frequency of tests
- Defects found and measures taken to remedy these defects
- Details of the person who carried out the test

The installation, commissioning and subsequent test data shall be forwarded to the Water Supplier and copies retained by the Tester and the Water Supplier's customer for a period of at least five years.

2400 PRESSURE REDUCING VALVES - INTEGRAL SENSOR TYPE:

Material

Bronze or DZR copper alloy body threaded to relevant parts of BS EN 10226
Stainless steel valve and seat and return spring.
Phosphor bronze bellows.
unless otherwise indicated

Components

Control spring and handwheel.
Integral sensor with an alpha/numeric pressure set-point indicator and locking facility.

2422 IN LINE DIFFERENTIAL PRESSURE CONTROL VALVES - DIRECT ACTING TYPE:

Provide valves to maintain a constant differential pressure downstream of the valve across a specific zone, mounted in the return pipeline.
Material

Cast iron Malleable iron body, brass or bronzebody.
Stainless steel seat, cone and return spring.
Phosphor bronze bellows.

Components

Control spring and actuator.
Valve body and bellows.

Connections

Threaded to relevant parts of BS EN 10226.
Or Flanged to BS EN 1092 parts 1,2 or as appropriate

2423 PRESSURE INPEPENDENT CONTROL VALVE (PICV): (NES 211.065)

Select, install and commission valves to provide the functions of flow limitation, modulating control and differential pressure control within a single valve body.
Commission valves in accordance with the manufacturer's recommendations and Commissioning Specialists Association TM18.
The valve manufacturer shall provide test results for each type and size of PICV to be used on the project in accordance with BSRIA Test Method for Pressure Independent Control Valves BTS 1/2012.
Limiting minimum operating pressure – 20Kpa.
For PICVs with a k_v value less than 0.4, a flushing drain should be incorporated in the pipework between the terminal unit and the PICV.

All PICVs' shall have an equal percentage control characteristic, be sized such that the design flow is within the setting range of the valve and be capable of closing against a maximum differential pressure that is greater than the pump head.

Type – Full stroke where the control and flow setting functions are separated within the valve and the full stroke of the valve is available for control (unless scheduled otherwise)

Valve characteristic/control - Equal percentage modulating (unless scheduled or described otherwise elsewhere in this specification).

Duties - To suit terminal unit design flow rates as detailed in equipment schedules.

Standard

Relevant parts of BS EN 60534

Valve leakage class to BS EN 60534-4 when shut off - IV.

Materials:

Body - DZR brass.

Globe or ball - brass.

Stem - brass.

O-Ring/diagram - EPDM rubber.

Springs - stainless steel.

Features - Facility to measure pressure drop across valves at commissioning.

Actuator - 0-10V proportional electric for modulating control or 3 point floating control.

2424 BYPASS DIFFERENTIAL PRESSURE CONTROL VALVES - DIRECT ACTING TYPE:

Provide valves to maintain a minimum circuit flow rate as system loads change.

Material

Cast iron Malleable iron body, brass or bronzebody.

Stainless steel seat, cone and return spring.

Phosphor bronze bellows.

Components

Control spring and actuator.

Valve body and bellows.

Connections

Threaded to Relevant parts of BS EN 10226.

Or Flanged to BS EN 1092 parts 1,2 or as appropriate

2430A DIRECT ACTING SAFETY VALVES COPPER ALLOY, SINGLE SPRING:

Material - Bronze or DZR copper alloy body.

Standard

BS EN ISO 4126-1, BS EN ISO 4126-7

Ends - Threaded to relevant parts of BS EN 10226.

Spring type - Single spring loaded, high lift type.

Protection from unauthorised adjustment

Fit a ferrule under adjusting screw.

or Fit compression ring under adjusting screw.

or Lock adjusting screw.

2430B DIRECT ACTING SAFETY VALVES COPPER ALLOY, DOUBLE SPRING:

Material - Bronze or DZR copper alloy body.

Standard

BS EN ISO 4126-1, BS EN ISO 4126-7

Ends - Threaded to relevant parts of BS EN 10226.

Spring type - Double spring loaded, high lift type.

Protection from unauthorised adjustment

Fit a ferrule under adjusting screw.

or Fit compression ring under adjusting screw.

or Lock adjusting screw.

2430C DIRECT ACTING SAFETY VALVES CAST IRON, SINGLE SPRING:

Material - Cast iron body.
Standard
BS EN ISO 4126-1, BS EN ISO 4126-7
Ends - Flanged to BS EN 1092-2
Spring type - Single spring loaded, high lift type.
Protection from unauthorised adjustment
Fit a ferrule under adjusting screw.
or Fit compression ring under adjusting screw.
or Lock adjusting screw.

2430D DIRECT ACTING SAFETY VALVES TO BS 6759, CAST IRON, DOUBLE SPRING:

Material - Cast iron body.
Ends - Flanged to BS EN 1092-2
Spring type - Double spring loaded, high lift type.
Protection from unauthorised adjustment
Fit a ferrule under adjusting screw.
or Fit compression ring under adjusting screw.
or Lock adjusting screw.

2440A DRAIN COCKS, THROUGHWAY GLAND COCK:

Standard – BS 2879
Bronze body with capilliary ends. Tapered plug with square shank for loose lever; bolted gland; strap and blank cap screwed on hand tight. Outlet to accept hose union. Locate at all low points

2460 DRAIN COCKS, BALL TYPE

Bronze or DZR copper alloy body; chrome-plated DZR ball; PTFE seats and stem seals; blow-out proof stem; strap and blank cap screwed on hand tight; serrated outlet to accept hose pipe. Lockshield key operated.

2470 TWO WAY GLAND TYPE VENT COCK:

Bronze body threaded to relevant parts of BS EN 10226.
Tapered plug with square shank for loose lever.
Plug position indicator.
Bolted gland.

2490 THREE WAY GLAND TYPE VENT COCK:

Components
Bronze body threaded to relevant parts of BS EN 10226.
Tapered plug with square shank for loose lever.
Plug position indicator.
Port markings to indicate inlet, vent, waste.
Bolted gland.
Port configuration, T port with stops.

2500A THREE WAY PLUG VALVE VENT COCKS:

Cast iron body, plug and bottom cover. PTFE thrust washer.
Ends - Flanged to BS EN 1092-2
T port configuration with stops. Wrench operation.

2511 AUTOMATIC AIR VENTS - FLOAT TYPE:

Construction
Bronze or DZR copper alloy body with threaded inlet to Relevant parts of BS EN 10226.
Provide a solid polypropylene float and air release valve. Ensure valve is self closing.
Provide
Connection to air vent for piping away released air.
Isolating valve.

Integral non-return valve.

Operating conditions

Maximum temperature, 130°C.

Maximum pressure 10 bar.

2516 DEAERATION UNITS - MICROBUBBLE TYPE:

For systems with less than 15m static head on heating and 5m on Chilled water

Type

Inline Temperature Differential Deaerator

Construction

Vertical mild steel housing, fitted with non-clogging helicoidal separation tubes and mesh / packing manufactured from copper tube, stainless steel or other proprietary material to create a the correct environment at the top of the unit to deaerate efficiently by separating the smallest microbubbles.

Maximum operating temperature and pressure of 110ºC and 10 bar.g.

Units to be compliant with The Pressure Equipment Regulations 1999.

For Chilled Water systems, the Deaerator shall be suitably insulated to prevent condensation

Provide air release mechanism comprising a solid polypropylene float not rigidly coupled to the air release valve. The air release valve shall be self closing. The AAV shall incorporate a 3-way valve allowing positive shut off to the AAV for servicing and protection from dirt during filling / flushing.

Ends

Screwed or flanged to BS EN 1092- 1, PN to match pipework

All Deareation equipment must be manufactured and supplied by companies complying with the requirements of “Lloyds register quality assurance ISO9001”. A Certificate of Compliance must be issued by this company for approval prior to orders being placed.

2521 DEAERATION UNITS - PRESSURE –STEP or VACUUM DEGASSER TYPE

For systems with greater than 15m static head on heating and 5 m on Chilled water

Type

Packaged Pressure Step Differential Deaerator complete with pump, casing and all necessary electronic controls.

The unit shall incorporate the following controls: air monitoring - auto start/shutdown; re-start every day by time clock; pump “ant-stick” start every three days; volt-free contacts for connection to BMS for fault indication.

The Deaerator shall have a vessel, where a volume of water from the main system is exposed to a vacuum and an automatic air vent.

For Chilled Water systems, the Deaerator shall be suitably insulated to prevent condensation.

Maximum operating temperature - 90oC.

Operating pressure range shall be selected to suit the system requirements.

The Deaerator shall be commissioned by the manufacturers representative.

The Pressure Differential Deaerator shall be electronically controlled

All Deareation equipment must be manufactured and supplied by companies complying with the requirements of “Lloyds register quality assurance ISO9001”. A Certificate of compliance must be issued for approval by the engineer prior to orders being placed.

2523 DIRT SEPARATOR UNITS:

Construction

Vertical mild steel housing. To ensure Deaeration and Dirt Separation are achieved the unit shall be fitted with a non-clogging cluster of spiral tubes manufactured from copper tube and wire to create an the correct environment at the bottom of the unit for dirt separation to occur.

The Dirt Separator unit shall have a standard maximum operating temperature and pressure of 110oC and 10 bar.g. respectively.

Units to be compliant with The Pressure Equipment Regulations 1999.

The pressure drop across the Dirt separator shall remain constant regardless of the amount of dirt trapped.

Ends -Screwed or flanged to BS EN 1092- 1, PN to match pipework

Dirt separation equipment must be manufactured and supplied by companies complying with the requirements of “Lloyds register quality assurance ISO9001”. A Certificate of compliance must be issued for approval by the engineer prior to orders being placed.

2524 COMBINED DEAERATOR & DIRT SEPARATOR:

For systems with less than 15 m static head on heating and 5 m on Chilled water
Type
Inline Combined Temperature Differential (microbubble) Deaerator & Dirt Separator .
Construction
Vertical mild steel housing, fitted with non-clogging helicoidal separation tubes and mesh / packing manufactured from copper tube, stainless steel or other proprietary material to create a the correct environment at the top of the unit to deaerate efficiently by separating the smallest microbubbles.
Maximum operating temperature and pressure of 110°C and 10 bar.g.
Units to be compliant with The Pressure Equipment Regulations.
For Chilled Water systems, the Deaerator shall be suitably insulated to prevent condensation
Provide air release mechanism comprising a solid polypropylene float and air release valve. Ensure valve is self-closing.
Provide dirt drain valve at its lowest point.
Ends
Line size with flanges to BS EN 1092-1, PN to match pipework
All Deareation & Dirt separation equipment must be manufactured and supplied by companies complying with the requirements of "Lloyds register quality assurance ISO9001". A Certificate of compliance must be issued for approval by the engineer prior to orders being placed.

2530 STEAM TRAPS TRAP SETS AND ANCILLARIES: (based on NES 211.250)
Comply with BS EN ISO 6553 for marking of steam traps and, where appropriate, BS EN 558 for dimensions.
Comply with BS EN 26948, ISO 6948 for production and performance characteristic tests for automatic steam traps.
Determine discharge capacity of automatic steam traps in accordance with BS EN 27842, ISO 7842.
Determine steam loss of automatic steam traps in accordance with BS EN 27841, ISO 7841.
Comply with BS EN ISO 6134 for rubber hoses and hose assemblies for saturated steam.

Steam trap monitoring to be automatic, continuous, monitoring steam leak and water logging detection unless indicated or scheduled otherwise.

2540 STEAM TRAPS - THERMOSTATIC TYPE, BALANCED PRESSURE:
Bronze or DZR copper alloy body with threaded ends to Relevant parts of BS EN 10226
Seamless stainless steel capsular element.
Stainless steel internal components with renewable seat.

2550 STEAM TRAPS - THERMOSTATIC TYPE, BI-METALLIC:
Steel body and cover with threaded ends to relevant parts of BS EN 10226 suitable for horizontal in-line mounting.
Thermostatic element in corrosion resistant multiple cross disc type bimetal stainless steel.
Integral stainless steel strainer.

2560 STEAM TRAPS - FLOAT TYPE:
Material
SG iron body.
Stainless steel float, air vent and internal components.
Ends - Threaded ends to relevant parts of BS EN 10226
Mounting
Horizontal in-line.
Options as indicated
Steam lock release facility.
Combined thermostatic air vent and steam lock release facilities.

2570 STEAM TRAPS - THERMODYNAMIC TYPE:
Material
Stainless steel body.
Stainless steel disc with screwed cap.
Ends
Threaded ends to relevant parts of BS EN 10226
Integral strainer with access plug and stainless steel screw.
Options as indicated.

Blowdown cock fitted to strainer cap.
Air venting disc.

2580 STEAM TRAPS - INVERTED BUCKET TYPE:
Cast iron body with threaded ends to relevant parts of BS EN 10226
Stainless steel bucket and internal components.
Integral strainer with access plug and stainless steel element.
Bolted cover with gasket.

2582 STEAM TRAPS - VENTURI ORIFICE TYPE:
Stainless steel single piece body with no moving parts and threaded ends unless indicated otherwise.
Integral strainer with access plug and stainless steel basket.

2584 AUTOMATIC PUMP TRAPS
Steam operated displacement receiver to automatically trap or pump condensate.
SG iron body with threaded ends to relevant parts of BS EN 10226
Design rating – PN16 unless scheduled otherwise
Pump discharge / cycle – 5 litres unless scheduled otherwise
Pumping capacity – as scheduled
Stainless steel float and internal components.
Integral SG iron strainer and steel drain plug
Bolted cover with gasket.

2590 STEAM TRAP FAILURE INDICATORS:
Materials
Cast iron sensing chamber body.
or Cast steel sensing chamber body.
Stainless steel internal sensor and sensor gasket.
Ends
Threaded ends to relevant parts of BS EN 10226.
Connect into assembly upstream of steam trap, as indicated.
Provide plug-in solid state electronic indicators complete with batteries, number as indicated (minimum 2No).
Provide central indicator panels as indicated and all interface wiring.

2600 SIGHT GLASSES:
Bronze or DZR copper alloy body threaded female to Relevant parts of BS EN 10226
Glass window.
Double window type.
Locate remote from fluid discharges to avoid damage by thermal or pressure shock conditions.

2611 EXPANSION LOOPS - STEEL:
Where indicated provide expansion loop in material and finish of associated pipeline. Forge bend from a single length of pipe or join by welding fittings if expansion loops are too large to manufacture in one piece.
Where a grooved steel pipework system is used the loops shall be designed by the system manufacturer.
Loop sizes shall be calculated using the CIBSE guidance. Calculations shall be undertaken to establish stress contained in the loop
Finish – to match pipework system

2620 EXPANSION LOOPS - COPPER:
Where indicated provide expansion loop in material and finish of associated pipeline. Forge bend from a single length of pipe.
Where a grooved steel pipework system is used the loops shall be designed by the system manufacturer.
Loop sizes shall be calculated using the CIBSE guidance. Calculations shall be undertaken to establish stress contained in the loop.

2631 EXPANSION COMPENSATORS:
Type
Unrestrained - Axial.
Restrained – Lateral, Angular gimbal

Ends

Threaded to relevant parts of BS EN 10226.

or Flanged to BS EN 1092-1 PN to match pipework.

Standards

Joints shall comply with the requirements of the Expansion Joints Manufacturers Association standard 1998 (EMJA). Expansion joints may be of the restrained or unrestrained type.

Design, manufacture and install metal bellows expansion joints in accordance with BS EN 14917.

General

Expansion joint convolutions shall be of a thick wall spirally wound, multi-ply construction with a corrosion resistant inner ply in AISI 316L stainless steel. Units shall be fitted with stainless steel inner sleeves.

For critical services such as MTHW, HTHW and steam, the bellows shall have a weep hole as a fail-safe device.

Expansion joints shall be capable of not less than 5000 complete reversals of movement at the given working conditions and the manufacturer shall be able to produce calculations to that effect.

Expansion joints shall be capable of withstanding a test pressure 1.5 times their design pressure without deformation.

The Contractor shall ensure the expansion joints are installed in accordance with the manufacturer guidelines for selection and installation. The manufacturer shall issue a Certificate of Compliance and appropriate expansion / anchor load calculations as part of the handover documentation.

Where a grooved system is used, liaise with the system manufacturer and ensure that the complete system (which may incorporate a combination of proprietary expansion devices and standard grooved couplings / fittings) is in accordance with their recommendations.

Unrestrained expansion joints

Axial expansion joints shall only be used in positions where pressure thrust can be contained by adequate anchor points contained by the building fabric. The expansion joint manufacturer shall submit calculations for anchor loadings for onward transmission to the Structural Engineer.

Restrained expansion joints

Restrained expansion joints shall be used as an offset type either by using lateral or angular expansion joints to compensate for thermal expansion or building movement. The expansion joint restraints shall be designed to absorb the full pressure thrust of the expansion joint convolutions.

Lateral expansion joints shall be of the thick wall spirally wound multi-ply construction and fitted with threaded tie bars and low friction self-lubricating hemispherical nuts, allowing movement in two planes.

Angular expansion joints shall be of the thick wall spirally wound multi-ply construction and be used in pairs or threes. All hinge pins shall be PTFE coated to reduce friction and prevent corrosion.

For movement in two planes Gimbal Expansion joints shall be used in pairs or in combination with one Angular Expansion joint. All hinge pins shall be PTFE coated to reduce friction and prevent corrosion.

All expansion joints must be manufactured and supplied by companies complying with the requirements of Lloyds register quality assurance ISO9001. A Certificate of compliance must be issued for approval by the engineer prior to orders being placed.

2631A SLIP TYPE GROOVED END EXPANSION COMPENSATORS:

Material - ductile cast iron to ASTM A536, grade 65-45-12.

Ends - grooved for mechanical joints.

Operation - supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.

Type - slip-type expansion compensation device, gasketed, with grooved coupling ends and 'telescoping' body.

Size - 50mm to 150mm.

Maximum axial end movement - 76mm.

Limiting test pressure - 24bar pressure rated.

Gasket - grade 'E' EPDM for water services to 110°C.

Installation to be strictly in accordance with the manufacturer's instructions.

2631B GROOVED END MULTIPLE FLEXIBLE COUPLINGS TYPE COMPENSATORS:

Coupling material - ductile cast iron to ASTM A536, grade 65-45-12.

Ends - grooved for mechanical joints.

Operation - supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
Type - multiple standard flexible grooved couplings joined by grooved end nipples.
Axial movement - dependent on number of couplings in the compensator, refer to schedule/particular specification.
Gasket - grade 'E' EPDM for water services to 110°C

2651 FLEXIBLE CONNECTIONS AND NOISE AND VIBRATION ABSORBERS

Generally

Flexible connections shall be fitted to all pump suction and discharge connections, chillers condensers and other centrifugal, reciprocating or vibrating plant

Flexible Connections must have certification to demonstrate they have been tested for Noise and Vibration reduction capabilities

Flexible Connections are to be fitted as close to the source of vibration as practicable. The pipework and flexible connections shall be installed to prevent any stresses in the pipework from being transmitted to the pump or vibrating equipment. To ensure correct alignment, a spool piece is to be employed during installation.

Rubber Flexible Connections shall be single convolution of hand laid multi ply reinforced EPDM rubber with wire reinforced cuffs. Flanges shall be removable and suitably profiled to control the convolution shape; plate flanges must not be used under any circumstances.

Threaded and adjustable tie bars with rubber top hat washers shall be used where the working pressure exceeds 1.5 bar.g. When untied flexible connections are used, the manufacturers recommendations for anchors and guides shall be followed to prevent forces being exerted on to the pump casing and AV mounts.

All flexible connections must be manufactured and supplied by companies complying with the requirements of “Lloyds register quality assurance ISO9001”. A Certificate of compliance must be issued for approval by the engineer prior to orders being placed.

Comply with the requirements of DIN 4809

Marking

The flexible Connections must be fully traceable: and moulded into the Flexible carcass shall be the manufacturer, country of origin, type and batch number, serial number, easily recognisable colour flashes and the date of manufacture.

Ends

Flanges to BS EN 1092 - 1 that can swivel and are removable; or threaded to relevant parts of BS EN 10226 with one union end to suit pipework as indicated.

Working temperatures up to 70ºC

Flexible carcass can be reinforced using high tensile synthetic fibre reinforcement.

Working temperatures between 70ºC and 100ºC

Flexible carcass must be steel wire mesh reinforced throughout. Connections are to have a minimum design life of 10 years, continuously operating at 100°C and a minimum burst pressure of 30 bar.g, in compliance with the minimum requirements of DIN4809: Part 1.

Working temperatures above 100ºC

Flexible Connections must be of thick wall spirally wound multi-ply construction stainless steel, all welded construction with tie rods.
Ends Flanges to BS EN 1092 - 1

2661 FLEXIBLE HOSES (COMPENSATORS) / TERMINAL UNIT CONNECTIONS

Application

Sealed LTHW and chilled water systems only

Standards

Flexible hose assemblies (up to 25mm nominal bore) for use in closed circuit heating and cooling systems shall be manufactured in accordance with BSRIA Guide BG 4/2004

Flexible hoses shall be installed in accordance with BSRIA Code of Practice 11/2002. (Flexible hoses a code of practice for services installers)

Material

EPDM inner liner with stainless steel wire braid. Nickel plated brass fittings with stainless steel ferrules.

Or corrugated metal in accordance with BS EN 14585-1 and PD CEN/TR 14585-3

Operation

Minimum length 300mm.

Ensure hose is capable of resisting kinking when bent through 180 deg.

Working pressure 15 - 20 bar and temperature 110 °C

or as otherwise indicated.

Other features

Supply chilled water connections fully insulated with end caps. The insulation shall form a vapour tight seal on the hose ferrules.

The hoses shall be colour-coded red and blue to indicate its suitability for LTHW and Chilled water.

Chilled water hoses shall be fully insulated and the insulation fitted with end caps.
The hoses shall have been thermal cyclic tested from 6^{o}C to 90^{o}C for at least 5000 cycles, carried out by an independent test authority.
All Hoses shall have a minimum 10 year warranty.

High temperature and critical applications

Where the operating temperature exceeds 100°C, flexible connections shall be constructed from convoluted stainless steel flexible hose, with a stainless steel wire braid, all welded construction.
The hoses shall be of annular corrugated construction and manufactured from AISI 321 Stainless Steel.

The hose shall be braided or unbraided to suit the temperatures and pressures.

Fitting shall be welded or brazed to suit the application. All hoses shall be 100% leak tested by the manufacturer.

The manufacturer shall be consulted to determine minimum flexible length and installation configuration.

All terminal connections must be manufactured and supplied by companies complying with the requirements of Lloyds register quality assurance ISO9001.

2662 FLEXIBLE HOSES FOR DRINKING WATER INSTALLATIONS & HOSES AS INTEGRAL PARTS OF APPLIANCES

Standards

Flexible hose assemblies for drinking water installations to connect sanitary tap ware, heaters and similar appliances operating temperature 70 °C to be in accordance with BS EN 13618.

Flexible hose assemblies intended to be used as integral parts of appliances, to be in accordance with BS EN 61770.

2663 HOSE AND HOSE ASSEMBLIES FOR STEAM AND CONDENSATE

Hose and hose assemblies for saturated steam and hot water condensate.
Standard - BS EN ISO 6134

Type 1 - low-pressure, maximum working pressure 6 bar

Type 2 - high pressure, maximum working pressure 18 bar

Incorporate an oil-resistant cover.

2670A TEST PLUGS, SELF SEALING:

Provide self-sealing test plugs with integral means of isolation, for measurement of temperature and pressure, complete with captive cap for sealing when not in use. Ensure test plugs are suitable for system operating temperature and pressure.

Provide one thermometer and pressure gauge for each range of conditions, for use with test plugs.

Install test plugs:

Either side of each strainer (unless integral with strainer)
Either side of each pump set
On the flow and return connection to each calorifier/heat exchanger/boiler/chiller/condenser
On the flow and return connection to each coil
Across the ports of each control valve
Elsewhere as necessary to allow the system to be commissioned in accordance with the CIBSE Commissioning Codes
Elsewhere as indicated

2671z TEST PLUGS, VALVE CONTROLLED:

On MTHW and HTHW provide self valve controlled test plugs for measurement of temperature and pressure, complete with captive cap for sealing when not in use. Ensure test plugs are suitable for system operating temperature and pressure.

Provide one thermometer and pressure gauge for each range of conditions, for use with test plugs. Install as 2670A.

2681 PIPELINE STRAINERS:

Ends

To match pipework. Screwed to relevant parts of BS EN 10226 or flanged to BS EN 1092-1 or BS EN 1092 – 2 or BS EN 1092 – 4 or grooved.

Pattern

Simplex basket, Duplex basket or Y pattern as indicated on schematic drawings or as scheduled

Screen free area

Not less than 250% of pipe bore or as indicated.

Screen perforations

15 - 50mm, within range 0.7 - 0.9mm diameter.
65mm and above, within range 1.5 - 1.8mm diameter.
unless otherwise indicated.
Internal to external flow through screen.
Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21.
At commissioning allow for the installation of temporary fine mesh screens in main system strainers.

2682 PIPELINE SUCTION GUIDE/STRAINERS:

Application – to provide a flow straightener to achieve optimum flow conditions
Body material - cast iron or ductile iron for water services to 110°C
Ends - flanged to PN16 or PN25 to suit system maximum working pressure.
Stainless steel strainer and fine mesh (start-up) strainer.
Unit to be complete with flow stabilising vanes to allow connection direct to pump suction.
Unit to be complete with removable stainless steel fine mesh sleeve start-up pre-filter.
Provide plugged connections for drain, air vent and differential pressure monitoring.
Installation to be strictly in accordance with the manufacturer's instructions.

2690C TUNDISHES:

Provide tundishes for all drains from equipment, located adjacent to equipment, or as indicated, in material to suit piping.

Material

Copper sheet nominally minimum 3mm thick.

or Mild steel galvanized after manufacture.

Construction

Form sheet into a tapered reducing cone with a minor diameter to suit drain line.

Major diameter nominally 50 mm larger than minor diameter, tapering at approximately 30 degrees.

2700z GAUGES:

Use dial type gauges of robust construction, enclosed in dust tight metal cases. Retain dial glass with bezels screwed to case. Finish with chromium plating.

Dial cases

In plant rooms

150mm diameter, heavy pattern, finished in black stove enamel.

In other areas

100mm diameter, finish chrome plated unless otherwise indicated

Use white dial scales indelibly and clearly marked with black lettering to indicate measured valves. Select scale ranges which indicate 'Normal' when pointer is vertical or central on scale.

Mount gauges with dial face in vertical plane and locate as follows

Direct

Support casing by connection to instrument, unless otherwise indicated.

2710z TEMPERATURE GAUGES:

Use temperature gauges with pocket and provided with gland attachment on thermometer stem.

Type

Mercury in steel, mounted direct in pocket.

or Vapour pressure to BS EN 13190, mounted direct in pocket with horizontal or vertical stem as appropriate.

or Vapour pressure to BS EN 13190, for remote mounting with capillary tube of sufficient length to allow slack run to immersion bulb. Protect capillary along full length by a flexible sheath jointed to dial case and bulb.

Use separable type pockets, threaded 15/19mm BSP and manufactured from stainless steel unless otherwise indicated.

Screw pockets into tapped bosses or stools set in pipelines or vessels. Fill pockets with oil to ensure contact with thermometer bulb.

Provide gauges with dial graduation in degrees Celsius marked on a logarithmic scale. Ensure pointer movement is clockwise for increase in temperature.

Provide sensing elements for air and gas systems, where indicated, and fix to provide airtight joints.

Provide with metal shielding around sensing element to prevent effects of local radiation from equipment.

2720 PRESSURE AND ALTITUDE GAUGES:

Use vapour pressure type gauges to BS EN 837-1. Connect to pipeline systems via matched gauge cocks and cock connectors.

Ensure dial graduation is from zero to between 1.5 and 3.0 times normal working pressure. Graduate in bar (gauge) on gauges reading head or working pressure, or in Pa where pressure differences across plant items are to be established. Where fitted on boilers and pressure vessels, clearly mark with operating and maximum permissible working heads in accordance BS 759. Elsewhere provide gauges with normal working pressure. Ensure dial movement is clockwise for an increasing in head.

Fit pig tail siphons and double isolation valves on steam, MTHW and HTHW systems. Use “U” siphons on all other services.

Provide flexible piping where gauge is subject to noticeable vibration.

Fit gauge cocks preceding all connections to altitude and pressure gauges. Copper alloy, tapered ground plug, with ebonite lever. Unless flanged joints are required, screw inlet ends female and fit outlet ends with union connections allowing removal of gauges.

2730 VACUUM GAUGES:

Use vacuum gauges complying with BS EN 837-1. Calibrate in mm of mercury.

2735 DIFFERENTIAL PRESSURE GAUGES:

Supply where indicated.

2740z GAUGE MOUNTING BOARDS:

Mount on walls or purpose made steel frames at a height approximately 1.3m above floor level as indicated

Manufacture from 12mm thick hardwood, and polish.

or Manufacture from 3mm mild steel plate, finished black stove enamel and trimmed with chromium plated strips approximately 10mm wide.

3000 ACCESSORIES

3010z LOOSE ITEMS:

Provide 5 no. tee handled short shank keys suitable for each size of valve spindle shank.
Provide one lever pattern key suitable for each drain cock.
Provide loose hose unions each for drain cock.

3020z VALVE SEAT REPLACEMENT

Provide a seat replacement tool for the TRV's, where fitted.

4000 WORKMANSHIP APPROVAL

Ensure all valves used on potable services have WRAS approval, and are so marked.

4010 INSTALLATION:

Install pipeline ancillaries in accordance with manufacturer's recommendations and BS 6683.

4021 LOCATION OF VALVES AND ANCILLARIES:

Install valves, cocks, traps, strainers, test plugs, tundishes and other ancillary equipment in positions indicated and as a minimum as follows:

Mains to isolate major sections of distribution.
The base of all risers and drops except in cases where one item of apparatus only is served which has its own local valve or stop tap.
Points of pipe connection of all items of apparatus and equipment except where the item could conveniently be isolated or regulated by valves provided for other adjacent items.
At all terminal units. (For hot and cold water services incorporate a flow regulator within the fitting isolation valve where the static pressure exceeds 1 bar).
Draw-off fittings except where ranges of fittings are served by a common float, the isolator then being fitted with the float.
At all sanitary fittings.
At all main branch connections

Locate drain valves at all low points

4025 LOCATION OF THERMOSTATIC RADIATOR VALVES:

Install thermostatic radiator valves in an area which reflects the space temperature. Ensure that they are not behind curtains or enclosed in heating or radiator panels.

4030 POSITIONING OF COMPONENTS:

Locate flow and pressure measurement and control valves to ensure manufacturer's recommended straight length of pipe upstream and downstream of valve is provided.

4040 POSITIONING OF DOUBLE REGULATING VARIABLE ORIFICE VALVE:

Install double regulating variable orifice valve to ensure equivalent of 10 diameters of straight pipe upstream and 5 diameters downstream of double regulating valve or in accordance with the manufacturers recommendations. .

4041 POSITIONING OF MEASURING STATION/COMMISSIONING SETS:

Install station to ensure equivalent of 10 diameters of straight pipe upstream of metering station and 5 diameters downstream of double regulating valve or in accordance with the manufacturers recommendations. .

4050 POSITIONING OF CONTROL COMPONENTS:

Install pipeline control components in accordance with manufacturer's instructions and in positions indicated.
Insulation

Where control components are incorporated in insulated pipelines

Provide details for approval of method proposed to insulate component.

Supports

Arrange supports for control components to ensure no strain is imposed on components.

Access

Arrange control components to ensure adequate access for operation and maintenance.

4060 VENT COCKS:

Provide outlets of vent cocks with discharge pipes terminated in a safe, visible & accessible location.

4070 VALVE STUFFING BOXES:

Adjust glands of all stuffing boxes at normal plant operating temperature and pressure in accordance with manufacturer's instructions. Ensure that valve action is not impaired by over tightening.

4080z DISCHARGE CONNECTIONS:

Fit pipework connections, where indicated, to

Provide

Discharge connection to Safety and Relief valves terminating at a safe discharge point.

Discharge connection to vent cocks terminating 150mm above floor level.

Bleed connection from air bottles terminating with air cock or needle valve in a convenient position.

Discharge pipe to automatic air vents terminating over a suitable gully or drain line in a visible location.

4090 EXPANSION DEVICES:

Arrange supports and fixings to accommodate pipe movement caused by the thermal changes, generally allow the flexure at changes in direction. Allow for movement at branch connections.

On drainage pipework use purpose designed fittings at changes of direction to accommodate movement, and to avoid stresses on connections to stacks.

Where possible provision for movement due to thermal expansion and contraction shall be made by natural changes in the direction of pipework.

Anchors and guides shall be positioned to contain all movement and resist the maximum loads imposed.

Anchors and guides are to be located at points which prevent excess stresses on pipework, joints and equipment connections. Similar provisions shall be made for building movement or building settlement.

Any provisions for expansion, anchors and guides shown on the drawings are for guidance, the actual requirements shall be determined by the Contractor.

The contractor shall utilize one of the named specialists and confirm in their tender submission that all provisions for pipework expansion have been included.

All loads on the building structure shall be advised to the Structural Engineer prior to the installation commencing.

4100 EXPANSION COMPENSATORS INSTALLATION:

Provide anchors and guides to contain all movement and resist maximum loads imposed. Install expansion compensators strictly in accordance with manufacturer's instructions.

Select and install metallic bellows expansion joints, test/inspect the systems after installation of the expansion joints and 1st full movement and provide certification in accordance with BS 6129-1.

4110 FLEXIBLE CONNECTIONS INSTALLATION:

Fit rubber bellows as close to source of vibration as practicable. Ensure the pipe at other end of bellows is a fixed point. Install flexible connections strictly in accordance with manufacturer's instructions.

Ensure flexible connections are tied when the plant is on vibration isolation mountings.

4120 TERMINAL UNIT CONNECTIONS INSTALLATION:

Install hose connections strictly in accordance with manufacturer's instructions.

4132 GAUGE MOUNTING LOCATIONS:

Mount gauges in the following locations:-

: Primary heating and cooling source - inlet and outlet pipeline temperature gauges.

: Pipelines leaving and entering plantrooms - temperature gauges.

: Main system pipeline headers - temperature gauge.

: Heat exchangers - primary and secondary pipelines inlet and outlet temperature gauges.
: Air handling plant - supply air temperature gauge.
: Pumps - suction and discharge connections pressure gauges mounted on a gauge board.
: Plant items - specified sensing points.
: Packaged plant, control panel mounted, gauges as specified.
: Elsewhere as indicated on the drawings.

10000 Based on NES TEXT May 19

Y20 – Pumps

1010 PUMPS:

Provide pumps manufactured and tested in accordance with appropriate British Standard as defined in clause 2201. Comply with safety requirements as BS EN 809, and BS EN 60335-2-51 where applicable.

1015 POTABLE WATER SERVICE PUMPS:

To be WRAS approved.

1020 PUMP SELECTION AND EFFICIENCY:

Select pump at or near most efficient part of performance curve for duty required.

Centrifugal glanded pumps

Comply with EU Regulation 547/2012 on Eco Design requirements of glanded centrifugal water pumps.
Do not select pumps on flat part of performance curve.
Pump efficiency

Pump efficiency tests shall be carried out in accordance with BS EN 16480.
Determine Energy Efficiency Index (EEI) in accordance with BS EN 17038-1 and BS EN 17038-2
Whenever possible select single stage glanded centrifugal pumps to achieve minimum pump efficiency (after correcting for pump head) equal to or better than defined by the upper efficiency line in figs 3 – 6 of the "European Guide to Pump Efficiency for Single Stage Centrifugal Pumps" as published by Europump 2003. (ie "Optimum efficiency selections). Pumps with a corrected efficiency between the upper and lower efficiency lines in this guide (ie efficient selections) will only be considered if it can be shown that an "Optimum efficiency" pump is not available.
Limiting Efficiency Index (MEI) to be as scheduled.

Motor / drive – Provide packaged pumps with motor and VSD integrated as part of the package unless scheduled otherwise.

Glandless Circulators.

Comply with EC Regulation 641/2009 and the amendment EU Regulation 622/2012 for glandless circulators.
Pump efficiency

Comply with BS EN 16297-1 and BS EN 16297-2 for general requirements and procedures for testing and calculation of the Energy Efficiency Index (EEI) for stand-alone circulators.
Comply with BS EN 16297-1 and BS EN 16297-3 for general requirements and procedures for testing and calculation of the Energy Efficiency Index (EEI) for circulators integrated into products.
Include EEI of pump on name plate together with an indication of which part of BS EN 16297 was applied for the determination of the EEI.
Limiting Energy Efficiency Index (EEI) to be as scheduled.

Motor - Provide electronically controlled permanent magnet type or EC motor.

1022 DESIGN DUTIES:

Pump Volume: Ensure scheduled volume is provided when operating against resistance of system corrected for changes between specified and selected component resistances.
Quoted pump duties are based on component pressure losses as scheduled in Y20sch. Adjust scheduled pump resistances to compensate for actual resistance of selected components.
Adjust pump heads if changes are made to pipework routing or arrangement in preparation of installation drawings or details.
Commissioning Allowance: Quoted pump duties include the following commissioning allowances:

Flow Rate	10%
Head	15%

These allowances are on top of the calculated design duty to allow for system regulation and additional fittings, unforeseen at the design stage and are not intended as "future spare capacity".
Pump Speed: Refer to schedule for maximum pump operating speed.

1024 BELT DRIVEN PUMPS

For each belt driven pump provide a change of belts and drives (to be sized after balancing the system). Allow for changing belts and drives and recommissioning pump and then rechecking system as necessary to achieve the specified duty.

1025 DIRECT DRIVE PUMPS

For each direct driven pump (both single pumps and twin headed pumps) without inverter or other speed control, allow for a change of impeller (to be sized after balancing the system). Allow for changing impeller and recommissioning pump and then rechecking system as necessary to achieve the specified duty.
All inline direct drive pumps for floor mounting shall be supplied with a proprietary support foot.

1026 TWIN HEADED CENTRIFUGAL PUMPS

Pumps shall be selected as duty and standby. All twin headed pumps shall be supplied with a matching blanking plate to enable the pump to be operated with a single head fitted during maintenance or replacement of standby head / impeller.
All pumps for floor mounting shall be supplied with proprietary support foot.

1030 SAFETY GUARDS:

Fit safety guards around revolving parts on close coupled and belt drive pumps.

1040 PUMP TESTING:

Hydraulic performance tests at manufacturer's test facilities

Ensure pumps comply with BS EN ISO 9906 or BS EN ISO 5198 where an extremely high accuracy of measurement is required.

Comply with reference section Y92 clauses for motors.
Ensure all pumps do not have any distinguishable, discrete continuous noise or give rise to distinct impulses.
Noise testing

When specified in the scope of works or schedules, undertake noise measurements in accordance with BS EN ISO 20361.

Glandless circulators having a rated input of up to 200W to be tested in accordance with BS EN 16644 for structure and fluid borne noise.

1045 PUMP MOTORS / STARTERS:

Refer to Controls / Monitoring section W60 and Y20 schedule for detailed requirements.
Comply with reference section Y72 clauses for starters.
Comply with reference section Y92 clauses for motors.
Variable speed drives specified as integrated with the pump shall be isolated from any vibration from the pump / motor and have a life expectancy no shorter than the motor life expectancy. Facility to connect to a BMS shall be incorporated into drives supplied by the pump manufacturer.

2000 PRODUCTS/MATERIALS

2011 CASING:

Provide casing with drain connection fitted with plug.
Provide threaded connections in accordance with BS EN 10226 for drains, vents, water jackets, cooling lines, etc.
Provide pump with split casing to allow access to the impeller for service and maintenance.

2015 VARIABLE FLOW CONTROL:

For variable volume systems, pumps shall be selected with a steep curve in the anticipated range of the system. This will ensure that a significant change in differential pressure occurs at the sensor as the flow varies, resulting in a significant change in pump speed and subsequent energy saving. Do not select pumps with flat curves; this will cause the pressure at the pump to stay roughly the same as the system resistance changes.
Where variable speed drives are fitted to direct drive pumps, ensure the drive meets the safety requirements of BS EN 61800-5-1.
Also comply with Y72 clauses for details of variable speed drives.

2016 IMPELLER:

Ensure impellers are accurately machined and finished smooth, free from blowholes and other defects and designed to be in dynamic balance at all speeds.
Provide open or semi-open type impellers for removal of sludge or other foreign material to prevent clogging.

Fix impellers to shafts to ensure that they remain firm if direction of rotation is reversed.
Indicate direction of rotation on pump casing.

2017 SHAFTS:
Ensure shaft is of adequate diameter to withstand all imposed loading and has a critical speed when assembled with its impeller at least 10% above normal operating speed.

2018 BEARINGS
Grease Points (where specified)
Provide bearings with lubrication line extended to grease nipple at convenient position with protection against over filling.

2019 SUCTION AND DELIVERY CONNECTIONS:
Flanged to BS EN 1092-2 or screwed to BS EN 10226 to match pipework.

2201 PUMPS (MATERIALS)

Type		A	C	E	E 1	G
Description		Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal Multistage
Configuration		Motor mounted vertically above casing on a common bedplate (belt driven)	Pump casing and motor mounted on a bedplate in line (close coupled)	Direct driven unit with pump body incorporating inlet and outlet connections in line, to allow pump to be mounted in pipework or floor mounted	Direct driven twin head unit with pump body incorporating inlet and outlet connections in line, to allow pump to be mounted in pipework or floor mounted	Motor mounted vertically above casing on a common pedestal (close coupled)
Pump Standards		BS EN ISO 9908 BS EN ISO 3661 BS EN 12756 BS EN 733	BS EN ISO 9908 BS EN ISO 3661 BS EN 12756 BS EN 733	BS EN ISO 9908 BS EN 12756 BS EN 733	BS EN ISO 9908 BS EN 12756 BS EN 733	BS EN ISO 9908 BS EN 12756
Material	**Casing**	Cast Iron to BS EN 1561	Cast iron to BS EN 1562	Cast iron to BS EN 1561	Cast iron to BS EN 1561	Cast iron to BS EN 1561
	Impeller	Gunmetal to BS EN 1982	Cast iron to BS EN 1562	Cast iron to BS EN 1561	Cast iron to BS EN 1561	Cast iron to BS EN 1561
	Shaft	Stainless steel to BS EN 10088	Stainless steel to BS EN 10088	Stainless steel to BS EN 10088	Stainless steel to BS EN 10088	Stainless steel to BS EN 10088
Bearings		Ball Sealed-for-life	Sleeve	Ball Sealed-for-life	Ball Sealed-for-life	Sleeve
Glands		Mechanical	Mechanical	Mechanical	Mechanical	Mechanical
Seal Housing		Cast Iron to BS EN 1561	Cast iron to BS EN1452	Cast iron to BS EN 1561	Cast iron to BS EN 1561	Cast iron to BS EN 1561
Drive		Belt	Close coupled	Direct coupled	Direct coupled	Direct coupled

Type		G1	I	I1	I2
Description		Centrifugal	Centrifugal	Centrifugal	Centrifugal
Configuration		Motor mounted vertically above casing on a common pedestal (close coupled)	Sealed unit with immersed rotor with pump body incorporating inlet and outlet connections in line, to allow pump to be mounted in pipework	Sealed unit with immersed rotor with pump body incorporating inlet and outlet connections in line, to allow pump to be mounted in pipework	Sealed unit with immersed rotor with pump body incorporating inlet and outlet connections in line, to allow pump to be mounted in pipework
Pump Standards		BS EN 12756	BS EN 16297 Parts 1&2	BS EN 16297 Parts 1&2	BS EN 16297 Parts 1&2
Material	**Casing**	Cast iron to BS EN 1561 Stainless steel to BS 1449 Part 2	Cast gunmetal to BS EN 1982	Cast iron to BS EN 1561	Cast iron to BS EN 1561
	Impeller	Stainless steel to , BS EN 10088	Stainless steel to , BS EN 10088	Noryl	Noryl

	Shaft	Stainless steel to BS EN 10088	Ceramic	Stainless steel to BS EN 10088	Stainless steel to BS EN 10088
Bearings		Sleeve	Pre-packed type requiring no maintenance (in-line pumps)	Sleeve	Sleeve
Glands		Mechanical			
Seal Housing		Cast iron to BS EN 1561	Gunmetal to BS EN 1982	Cast iron to BS EN 1561	Gunmetal to BS EN 1982
Drive		Direct coupled	Direct coupled	Direct coupled	Direct coupled

Type		I3	K1	K	M
Description		Centrifugal	Centrifugal	Centrifugal	Centrifugal
Configuration		Sealed unit with immersed rotor with pump body incorporating inlet and outlet connections in line, to allow pump to be mounted in pipework	Pump casing and motor in line (close coupled) sealed vertical assembly	Pump casing and motor in line (close coupled) sealed vertical assembly	Motor mounted vertically above casing on a common pedestal (close coupled)
Pump Standards		BS EN 16297 Parts 1&2	BS EN ISO 9908 BS EN 12756	BS EN ISO 9908 BS EN 12756	BS EN ISO 9908 BS EN 12756
Material	**Casing**	Cast iron to BS EN 1561	Stainless steel to and BS EN 10088	Cast iron to BS EN 1561or Cast gunmetal to BS EN 1982 or Cast steel to BS EN 10213 or SG iron to BS EN 1563 or Stainless steel to BS EN 10088	Cast iron to BS EN 1561
	Impeller	Stainless steel to and BS EN 10088	Stainless steel to BS EN 10088	Cast iron to BS 1452 or Gunmetal to BS 1400 or Stainless steel to BS EN 10088 or Ni-resist to BS EN 13835	Maranyl
	Shaft	Stainless steel to BS EN 10088	Stainless steel to BS EN 10088	Stainless steel to BS EN 10088 or high tensile carbon steel	Stainless steel to BS EN 10088
Bearings		Pre-packed type requiring no maintenance (in-line pumps)	Sleeve or Ball or Sealed-for-life or Spherical roller or Pre-packed type requiring no maintenance (in-line pumps) or Water lubricated (sealed unit in-line pump) or grease point	Sleeve or Ball or Sealed-for-life or Spherical roller or Pre-packed type requiring no maintenance (in-line pumps) or Water lubricated (sealed unit in-line pump) or grease point	Sleeve
Glands			Mechanical	Mechanical	Mechanical
Seal Housing		Cast iron to BS EN 1561		Cast iron to BS EN 1561 Gunmetal to BS EN 1982	
Drive		Direct coupled	Direct coupled	Direct coupled or Close coupled	Direct coupled

Type		S	S1	V
Description		Positive displacement	Positive displacement	Positive displacement
Pattern		Helical	Helical	Rotary
Material	**Casing**	Cast iron to BS EN 1561 or SG iron to BS EN 1563 and BS EN 1564	Cast iron to BS 1452 or SG iron to BS EN 1563	Cast iron to BS EN 1561

	Impeller			
	Shaft			High tensile carbon steel
Bearings		Spherical roller	Sleeve or Ball or Sealed-for-life or Spherical roller or Pre-packed type requiring no maintenance (in-line pumps) or Water lubricated (sealed unit in-line pump) or Grease point	Sleeve
Glands		Mechanical	Mechanical	Packed
Seal Housing		Cast iron to BS EN 1561	Cast iron to BS EN 1561	Cast iron to BS EN 1561
Drive		Direct coupled	Direct coupled	Direct coupled

3000 ACCESSORIES

3010 DRIVE BELTS:
Provide belt driven pumps with two or more belts.

3020z MATCHING FLANGES:
Provide flanged pumps with matching flanges to relevant part of BS EN 1092, pressure/temperature to match pipework.

3031 DRAIN LINES FROM PACKED AND WATER-COOLED GLANDS:
Provide copper drain lines complete with tundish from glands to nearest drain. To facilitate cleaning use plugged tees instead of elbows.

4000 WORKMANSHIP

4010 GENERAL:
Comply with manufacturer's recommendations for installation of pumps. For in-line pumps ensure that motor is positioned in accordance with manufacturer's requirements. Do not install glandless pumps with the shaft in the vertical.

4020z PIPELINE CONNECTIONS:
On other than small in-line circulators, support pumps independently from connecting pipework to ensure no load is transmitted from pipework to pump casing on pump suction and discharge.

4030z MOUNTINGS:
Mount motors and pumps for belt drive pumps resiliently. Comply with reference section Y52 clauses.

4050 ALIGNMENT:
Align pump to prevent undue restraint and thrust on interconnecting pipework.
Align drives to prevent undue wear and restraint on pump shaft.
For belt drives, align pulleys and tension belts to prevent undue wear and out of balance forces.

4060 ACCESS:
Locate pump within the system with adequate space around it for service and maintenance.

4070 MAINTENANCE REQUIREMENTS FOR SEWAGE PUMPS:
For ease of service and maintenance, install submersible sewage pumps on guide rails or with lifting cables.
Fit pumps with automatic discharge connections, which
Locate on to permanent pipework at low level in chamber.

10000 BASED ON NES Y20TEXT Dec 19

Y21 – Water Tanks/ Cisterns

1011 TANK DESIGN:

Design and fabricate tanks/cisterns in accordance with British Standards and HSE requirements including but not limited to BS EN 806 parts 1-5, BS 8558 and HSG 274 Part2.

All split storage tanks shall be configured such that either section can be used while the other is being maintained.

On healthcare projects comply with HTM 04-01: Safe water in healthcare premises.

1021 STORAGE WATER CISTERNS

Cisterns supplying water for domestic purposes (i.e. water supplied for drinking, washing, cooking and sanitary purposes) shall comply in all respects with relevant regulations:

England and Wales - The Water Supply (Water Fittings) Regulations 1999, the Water Act 2014 and the Construction Products Regulations 2013.

Scotland - The Water Supply (Water Fittings) Byelaws 2014.

Northern Ireland - The Water Supply (Water Fittings) Regulations (Northern Ireland) 2009.

All cisterns / tanks shall be provided with a drain valve (50mm dia minimum) at their lowest point.

1022 DEFINITIONS:

Cistern:	An open top rectangular vessel.
Tank:	An open or closed top rectangular vessel as defined in particular BS.
Water line:	Highest level of water at which a cistern or open top tank is designed to work.
Capacity:	Capacity of an open topped vessel when filled to water line. Capacity of a closed top vessel when filled to top of vessel.
Working Pressure:	Static head represented by maximum depth of tank or cistern. For closed tanks, vertical distance from bottom of tank to water level of cistern feeding it.

2000 PRODUCTS/MATERIALS

2005 CONNECTIONS

Outlet connections shall be at the opposite ends to inlets and in large cisterns and tanks, diagonally offset.

2011 SECTIONAL STEEL TANKS:

Jointing

Strip to suit potable cold water & WRC approved or as scheduled.

Internal and external coating

One coat bitumous primer, suitable for potable water WRC approved applied before delivery and erection and two further coats after erection or as scheduled. On potable services the treatment shall comply with WRC requirements.

Connections and drillings

To manufacturer's standards. Welded socket connections for connections up to 25mm dia. welded flange connections for connections greater than 25mm dia.

Supports

To manufacturer's guidelines.

Inspection

Allow for inspection at manufacturer's works.

Erection

Erection of tank on site to be undertaken by tank manufacturer

2021 GLASS REINFORCED PLASTICS SECTIONAL TANK TO BS EN 13280 CLASS A1 OR A2:

Class A1 or A2 for potable water.

Plate Flanges	-	External
Tank Top	-	Closed
Manhole	-	as indicated
Divisions	-	as indicated
Erection	-	by supplier
Ladder	-	Standard -BS 4211
Supports	-	Provide transverse supporting bearers
Materials	-	As BS EN 13121-1.

2022 GLASS REINFORCED PLASTICS SECTIONAL TANK TO BS EN 13280 CLASS B:

class B for non-potable water.

Plate flanges	-	External
Tank Top	-	Closed
Manhole	-	as indicated
Divisions	-	as indicated
Erection	-	by supplier
Ladder	-	Standard BS 4211
Supports	-	Provide transverse supporting bearers.
Materials	-	As BS EN 13121-1.

2041 PREFABRICATED STEEL CISTERNS:

Standard

Galvanised - BS 417 Part 2

Connections

As BS 417 Part 2 or as otherwise scheduled.

Internal and external coating

One coat primer , two further coats or as otherwise scheduled. On potable services the treatment shall comply with WRC requirements.

2051 MOULDED PLASTIC CISTERNS:

Standard

BS 4213. (up to 500 litre)

2061 GLASS REINFORCED PLASTICS CISTERNS:

Standard

BS EN 13280 (500litre to 100,000litre)

Materials

As BS EN 13121-1.

3021 TANK ANCILLARIES

Detailed project specific requirements as scheduled or indicated on the drawings.

Manholes, to be provided over ball valve locations with separate manhole for access into tank.

Contents gauges to be Hydro Static type (“cat and mouse” type indicators shall not be used due to their tendency to encourage algai growth).

Float type high and low level alarms and necessary boss connections

Access ladders to BS 4211. (Internal to be stainless steel or GRP, external to be galvanised steel).

Temperature probes to be positioned 300mm below top layer level and 300mm above bottom of tank.

4000 WORKMANSHIP

4010 GENERAL:

Store, handle and erect all in accordance with manufacturer's recommendations, relevant British Standards and The Water Supply (Water Fittings) regulations 1999.

Make due allowance for valves, fittings, access, etc., to accommodate insulation and weathering where indicated.

4020 PROTECTION AND CLEANING:

Ensure adequate protection from damage and ingress of foreign matter to tanks and cisterns during storage, erection and commissioning.

Thoroughly clean out all tanks and cisterns prior to site testing and commissioning.

4030 INSPECTION AND ACCESS:

Install tanks and cisterns to allow internal and external surfaces to be easily inspected and cleaned.

Y21 – Water Tanks/ Cisterns

4040 INSTALL MOULDED PLASTIC CISTERNS:
In accordance with Appendix R of BS 4213.

4051 INSTALL SECTIONAL STEEL TANKS:
In accordance with manufacturer's recommendations.

4061 INSTALL GLASS REINFORCED PLASTICS CISTERNS:
In accordance with instructions in BS EN 13280.

10000 NES
Based on Y21TEXT Sept 18

G1005 DEFINITION

The materials, apparatus and methods detailed throughout the ductwork component schedules and specification clauses apply to all enclosures for conveying air, and their ancillaries, whether as ducting runs or casings for equipment and accessories.

1007 DESIGN

Ensure that the design velocities and pressure conditions comply with the values and tests specified.

1010 DUCTWORK AND ANCILLARIES INSTALLATION STANDARDS:

Carry out construction and installation of ductwork in accordance with BESA DW/144, DW/145, DW/154, DW/172 and DW/191 and BS 9999 as appropriate / scheduled.

Comply with BS EN 1507, BS EN 12237, and BS EN 13403 (Ductwork made from insulation ductboards) as appropriate / scheduled.

Where builders work ducts are used they shall be thoroughly cleaned and sealed prior to plant operation.

Where ducts penetrate a floor separating habitable rooms in different flats within residential buildings they shall be enclosed for their full height and full horizontal run in each flat and surrounded with sound absorbent material above and below the floor. The installation shall comply with the requirements of Approved Document E of the Building regulations. “Resistance to the passage of sound”.

Install and inspect fire resisting duct systems in accordance with Building Regulations and ASFP Code of Practice TGD 18.

1021 DUCTWORK DIMENSIONS:

Sizes of ductwork are internal airway dimensions. Where applicable make allowance for any internal lining.

1022 DUCTWORK LAYOUT

Set out ductwork as indicated on the drawings, making due allowance for any diagrammatic presentation. Provide all necessary offsets, bends, tapers, transformation pieces etc. required whether or not these are detailed. Make due allowance for any thermal movement on long runs.

1031 ELECTRICAL BONDING TERMINAL:

Ensure an electrical bonding terminal suitable for connection of 6mm^2 maximum conductor is provided where required by BS 7671 Requirements for Electrical Installations clause 544.1

1041 INSTALLER SELECTION: (NES 230.020)

Use a member of the BESA (Building Engineering Services Association) specialising in manufacturing and installing ductwork.

Where post installation cleaning is specified, appoint a specialist cleaning contractor to undertake the work in accordance with BESA TR/19, and supply and install any additional cleaning openings to suit their selected specific methods of cleaning and to suit the practical site conditions relative to the fabric of the building and position of other services.

For existing systems that require inspection and cleaning prior to modification or re-commissioning (including kitchen extract systems):

Use a specialist, approved in accordance with Loss Prevention Standard LPS 2084, to undertake the following:

- Inspect and clean ductwork that may be contaminated with combustible deposits.
- Make recommendations for access improvements to any areas where there is currently limited access making cleaning / maintenance impractical.

2000 DUCTWORK FABRICATION/MATERIALS

2011 DESIGN INFORMATION:

General

All ductwork and associated materials shall be manufactured, installed and tested, in accordance with the current editions of BESA Specification DW/144 and DW/154 for sheet metal ductwork and plastic ductwork respectively, for low, medium and high pressure/velocity air systems, and as qualified in this specification.

Ductwork Classification

Ductwork to be used on this project shall be as scheduled.

The ductwork pressure classifications scheduled are in accordance with the limits for positive/negative static pressure, air velocity and air leakage defined in table 1 in DW144.
Fabricate ductwork to meet pressure classification in accordance with DW/144 Table 1 and DW/154 table 1. Fabricate ductwork to meet leakage classification in accordance with DW/144 Table 1 and DW/154 table 1. Where indicated ensure ductwork is suitable for a variable air volume system.
For special installations where contaminants are indicated, ensure materials and construction of ductwork are suitable for contaminants in the airstream.

2024 DUCTWORK AIR LEAKAGE TESTING - GENERAL:

Carry out ductwork air leakage testing on those sections of systems with a design flow rate greater than 1m^3/s where the pressure class is such that DW/143 recommends testing and where the BER calculation assumes a leakage rate lower than the standard in DW/144.
Test to be in accordance with the requirements of the latest version of Building Regulations ADL2 A&B and DW/144 or appendix A in DW/154 as appropriate and as procedures set out in DW/143. Use portable fan and test equipment and apply to erected sections of the ductwork complete with access doors at the test pressure and flow rates as scheduled.

Test before insulation is applied to ductwork.
Achieve leakage rates indicated or better.
Test ductwork components with the ductwork, where they are able to withstand the test pressure, otherwise isolate.

If the test fails, pressure test four further sections. If the further tests fail apply remedial action to the complete ductwork system.

The results to be recorded on test sheets based on DW/44 or DW/154 and DW/143 examples and compared to acceptable leakage rate specified or better.

Sections, which need unacceptable levels of remedial work on seams or joints, shall be replaced by new sections. This requirement shall be identified during the preliminary test to DW 143.

Provide documented evidence of the calculations used to arrive at the allowable loss for the section to be tested and ensure the client or their representative witness and sign the results of the tests.

All "in duct" plant shall be factory tested to the same leakage classification by the Manufacturer.

Builders work ducts used as part of a ductwork supply system shall be sealed in accordance with the Architect's specification by the Contractor. The ducts / shafts shall be leakage tested to demonstrate that leakage is no greater than the requirements for sheet metal ductwork class A as defined in DW/143 at the design pressure at that part of the system.

For pressure and leakage testing - builder's work shafts, voids, enclosures and floor voids / plenums refer to clause Y51 2015.

2025z SPARK TESTING ON PLASTICS DUCTWORK:

Where specified in the scope of works or schedule of air ductlines, carry out spark testing in accordance with DW/154 at land marks identified in the contract programme.

2031A HIGH PRESSURE DUCTWORK AIR LEAKAGE TESTING:

Carry out ductwork air leakage testing on all high-pressure ductwork in accordance with DW/144 as procedures set out in DW/143.
Testing of plant items, as DW/144.

2031B MEDIUM PRESSURE DUCTWORK AIR LEAKAGE TESTING:

Test medium pressure ductwork in accordance with DW 144 and DW143.
Test the specified proportion of sections of duct system (as scheduled) for air leakage. Test at the pressure recommended in DW144 for the classification of the selected ductwork. Carry out the tests as the work proceeds and prior to application of thermal insulation.
If the test on a section fails, pressure test four further sections (to be selected by the Designer). If the further tests fail, apply remedial action to the complete ductwork system.

Provide documented evidence of the calculations used to arrive at the allowable loss for the section to be tested and ensure the client or their agent witnesses and signs the results of the tests.
Testing of plant items as DW 144.

2031C LOW PRESSURE DUCTWORK AIR LEAKAGE TESTING:

Test low-pressure ductwork in accordance with DW 144 and DW143 as scheduled.
Test the specified proportion of sections of duct system for air leakage. Test at the pressure recommended in DW144 for the classification of the selected ductwork. Carry out the tests as the work proceeds and prior to application of thermal insulation.
If the test on a section fails, pressure test two further sections (to be selected by the Designer). If the further tests fail, apply remedial action to the complete ductwork system.
Provide documented evidence of the calculations used to arrive at the allowable loss for the section to be tested and ensure the client or their agent witnesses and signs the results of the tests.
Testing of plant items as DW 144,

2035 STRENGTH AND LEAKAGE TESTING OF CIRCULAR SHEET METAL DUCTWORK:

Where scheduled carry out ductwork strength and air leakage testing on circular sheet metal ductwork in accordance with BS EN 12237.
Test procedure shall be as detailed in BS EN 12237, Section 7.
Produce a test report as detailed in BS EN 12237, Section 8.

2036 STRENGTH AND LEAKAGE TESTING OF RECTANGULAR SHEET METAL DUCTWORK

Where scheduled complete systems shall be leakage tested. Tests shall be carried out when the fan has been first set to work and a visual/audible inspection has been made of all connections from plant to ductwork. This shall include any untested joints between tested sections and all joints and seams not previously subjected to leakage pressure tests, including plant casings, grille joints, dampers etc.
Carry out ductwork strength and air leakage testing on rectangular sheet metal ductwork in accordance with BS EN 1507

2041 DUCTWORK MATERIALS STEEL

Ductwork shall be zinc-coated steel to DW144 Part 2 unless otherwise specified. Where scheduled, external ductwork to be hot-dip galvanized to BS EN 10346

2061A STEEL DUCTWORK TO DW 144 - RECTANGULAR:

Duct

Comply with DW 144 Part 3 for construction of rectangular ductwork.

Additional requirements

Any duct with an aspect ratio greater than 4:1 shall be supplied complete with a central splitter.
Longitudinal seams: Fig Nos. 5, 6 and 7 shall be avoided. Fig No 8 may be used on large duct components with the Designer's approval.
For all side-on flange systems (mezz etc) with bolted corners, joints on all systems shall be further secured with intermediate fastenings to the manufacturer's recommendation.
Full girth stiffeners shall be used in all instances.
Dimpling is not acceptable as a method of fastening.
Plant connection shall be constructed at Tables 2, 3 and 4, but one gauge thicker. Tie bars shall be provided on all plant connections with a side longer than 1500mm.
Turning vanes shall be fitted on square bends. Square branches shall not be used.

Cross-joints

Use cross-joints in accordance with DW 144 or use cross-joints tested in accordance with DW/TM1, unless otherwise indicated.

Finish

Zinc coated steel - hot dip galvanised, or Zinc coated steel - electroplated, or pre-coated steel in accordance with DW 144

2061B STEEL DUCTWORK TO DW 144 - CIRCULAR:

Duct

Comply with DW 144 Part 4 for construction of circular ductwork. Use spirally wound ducts unless otherwise indicated.

Additional requirements

Fig Nos. 34 and 41 in DW 144 will only be acceptable as a means of jointing provided the manufacturers of the proprietary system inspect a minimum of 25% of the joints after installation to verify the installation has been carried out in accordance with their instructions and size limitations.

Components

Square branches shall not be used. On high and medium pressure systems use only conical branches

Fittings

Comply with DW 144 Part 4 for manufacture of fittings for circular ductwork.

Cross-joints

Use cross-joints in accordance with DW 144 or use cross-joints tested in accordance with DW/TM1, unless otherwise indicated.

Finish

Zinc coated steel - hot dip galvanised, or Zinc coated steel - electroplated, or pre-coated steel in accordance with DW 144 Appendix H unless otherwise indicated.

2061C STEEL DUCTWORK TO DW 144 - FLAT OVAL:

Duct

Comply with DW 144 Part 5 for construction of flat oval ducts. Use spirally wound ducts unless otherwise indicated.

Cross Joint

Submit for approval details of any cross-joints not in accordance with DW

Components

Square branches shall not be used; on low-pressure systems use shoe branches in lieu. On high and medium pressure systems use only conical branches.

Fittings

Comply with DW 144 Part 5 for manufacture of fittings for flat oval ductwork.

Finish

Zinc coated steel - hot dip galvanised, or Zinc coated steel - electroplated, or pre-coated steel in accordance with DW 144 unless otherwise indicated.

2062 HIGH PRESSURE SHEET METAL DUCTWORK

Where high-pressure ductwork is specified, the following shall apply otherwise stated in writing:

Bends and offsets shall have a minimum throat radius equal to the width or diameter of the duct. On rectangular duct over 1 metre wide or where space is restricted, splitters may be introduced with the prior written approval of the Designer. Locations for dampers for volume control shall be agreed with the Designer.

Requirements of the relevant Clauses in DW 144 must be adhered to.

2065 KITCHEN EXTRACT SYSTEMS

Refer also to clause 310.031 in U10 (U12)

Kitchen extract ductwork to be fire resisting as scheduled.

Comply with BESA “Specification for Kitchen Ventilation Systems DW172. Appendix D and DW/144

As a minimum, all ductwork shall be constructed to Class "A" specification and tested to Class "B" requirements and be increased at least one size in metal thickness above the standard requirement. Access doors for cleaning (with grease tight gaskets) shall be installed at every bend and connection and at every 3m on straight lengths of ductwork. All joints shall be grease-tight. Horizontal ductwork shall be installed to provide a fall to a drain point. A drain connection shall be provided at all low points.

Comply with Section 7 of BESA TR/19 for facilities and specific requirements for cleaning.

Comply with the requirements of the Building Control Officer for fully welded ductwork, fire cladding and minimum metal thickness.

The entire system installation shall comply with the requirements of the Building Control and Fire Officer.

2071 MAN ACCESS AND SAFETY BARS:

Where man access is provided, ensure that duct floor is of sufficient strength to comply with safety standards. Provide safety bars at the top of all risers unless alternative means of protection are provided.

2072 FLANGED CONNECTIONS:

Provide bolted flanged joints for connecting ductwork to flanged items of plant, builder's work frames and where removable sections of ductwork are required.

2074 PLANT CONNECTIONS:

Make connection between air handling assembly and ductwork system in accordance with DW 144 and manufacturers recommendations.

2101 PLASTICS DUCTWORK TO DW 154:

Manufacture and install plastic ductwork in accordance with DW 154.
Material
PVC-U (Unplasticized polyvinyl chloride).
PPS (Self extinguishing polypropylene).
FBPP (Fabric backed polypropylene sheet).
PVC-U/GRP (Composite laminate of unplasticised polyvinylchloride and glass reinforced plastic).
PVC-U/FOAM/GRP (Composite laminate of unplasticised polyvinylchloride, rigid polyurethane self extinguishing foam and glass reinforced plastic).
FBPP/FOAM/GRP (Composite laminate of fabric backed polypropylene sheet, rigid polyurethane self extinguishing foam and glass reinforced plastic).
Construction
Rectangular ducts DW 154 Part 3.
Provide internal stiffeners.
Circular ducts DW 154 Part 4.

2102 NON-METALLIC DUCTWORK TO BS EN 17192:

Supply ductwork manufactured in accordance with BS EN 17192
Air tightness class – as scheduled
Material – as scheduled
Types

Semi rigid duct which cannot be manually longitudinally compressed or decompressed but can be flexed in at least one direction without permanently damaging the cross sectional area.

Rigid duct which cannot be manually longitudinally compressed or decompressed and cannot be flexed in any direction without permanently damaging the cross sectional area.

2110A FIRE PROTECTION WITH FIRE DAMPERS:

Method of protection where ventilation ducts pass through fire-separating elements

BS 9999 Method 1 and Method 4 protection using fire dampers and / or automatically actuated fire and smoke dampers triggered by smoke detectors.

Installation to comply with:

BESA DW / 144 and DW/145
Building Regulations Approved Document B
BS EN 15650 – Ventilation for buildings. Fire dampers
Relevant parts of BS EN 1366, BS EN 13501 and BS EN 12101

2110B FIRE PROTECTION WITH FIRE RESISTING ENCLOSURES:

Method of protection where ventilation ducts pass through fore-separating elements -

BS 9999 Method 2 using fire resisting enclosures.

Installation to comply with:

BESA DW / 144

Building Regulations Approved Document B

Relevant parts of BS EN 1366, BS EN 13501 and BS EN 12101

2110C FIRE RESISTING AND SMOKE AND HEAT CONTROL DUCTWORK GENERALLY:

Supply and install fire resisting ductwork using either fire protection cladding on-site, factory applied fire resisting finish or factory manufactured fire rated ductwork, as detailed elsewhere in this specification.

Ducts constructed to BESA DW/144 has no tested fire resistance, therefore when using protective cladding materials, construction of base duct must comply with the actual construction of the tested duct specimen and cladding material.
Method of protection where ventilation ducts pass through fire-separating elements
BS 9999 method 3: protection using fire-resisting ductwork.
Ensure complete ductwork system complies with EN testing requirements to relevant parts of BS EN 1366, be tested by a UKAS accredited notified body and comply with Building Regulations Approved Document B or equivalent in devolved nations in UK.

The ductwork shall be constructed in accordance with the ASFP (Association of Specialist Fire Protection) Guide to Fire Rated and Smoke Extract Ductwork to provide the Fire Rating for Integrity & Insulation (BS EN EI nomenclature) when tested to the requirements of BS EN 1366 Parts 1, 8 or 9 depending on system function by a UKAS accredited notified body. The ductwork providing either duct type A (fire outside), Duct Type B (fire inside) or Duct Type C (fire inside smoke control duct) and, under normal non-fire operating conditions, shall conform to the scheduled pressure classification of the current BESA DW/144 specification for sheet metal ductwork.
All smoke extract ductwork shall be capable of retaining a cross sectional area of 90% under fire conditions in accordance with BS EN 1366 Part 8 for multi compartment smoke extract systems. Comply with BS EN 12101-7 for this purpose.

Projects in Non EU markets only
The ductwork shall be constructed in accordance with the ASFP (Association of Specialist Fire Protection) Guide to Fire Rated and Smoke Extract Ductwork to provide the Fire Rating for "Stability", "Integrity" and "Insulation" as scheduled or indicated in the particular specification or on the drawings, when tested to the requirements of BS 476: Part 24 by a UKAS approved laboratory.

2110D FIRE RESISTING AND SMOKE AND HEAT CONTROL DUCTWORK WITH FIRE PROTECTION CLADDING:

Ensure complete system complies with testing requirements to BS EN 1366 Parts 1, 8 or 9 depending on system function. In the case of smoke extract ducts to conform to the requirements of BS EN 12101-7.
Classification documents to be in accordance with BS EN 13501-3 for ventilation ducts and BS EN 13501-4 for smoke control ducts sections.
Ducts to be fire protected with the correct thickness of high density single layer mineral wool fire rated ductwork slab in accordance with the manufacturer's recommendations and instructions. Insulation to be independently tested and carry valid classification documents to BS EN 13501-3 Parts 1,8 or 9 depending on system function by a UKAS accredited body. The ductwork providing either duct type A (fire outside), Duct Type B (fire inside) or Duct Type C (fire inside smoke control duct). All smoke extract ductwork shall be capable of retaining a cross sectional area of 90% under fire conditions in accordance with BS EN 1366 Part 8 for multi compartment smoke extract systems. Comply with BS EN 12101-7 for smoke and heat control duct systems which are manufactured off site as such and then placed on the market for this purpose.

General
Ductwork to be in accordance with BESA Specification DW/144. Ducts constructed to this specification has no tested fire resistance therefore when using protective cladding materials construction of base duct must comply with the actual construction of the tested duct specimen and cladding material.
Drop rods and exposed bearers to be insulated in accordance with manufactures recommendations and instructions.
Where a vapour barrier is required, all exposed edges and penetrations through the foil should be sealed using soft self-adhesive aluminium foil tape.
Refer to clause Y50.2195 for further details of fire protection cladding.

Projects in Non EU markets only
Ensure complete ductwork system complies with the requirements of BS 476-24 and BS 9999.
Supply and install fire rated ductwork. Ducts to be fire protected with the correct thickness of high density single layer mineral wool fire rated ductwork slab in accordance with manufacturers recommendations and instructions. Insulation system to be independently tested and carry current valid certification to provide fire protection fully in accordance with the requirements of duct 'Type A' and duct 'Type B' of BS 476-24 and BS 9999.
Testing to be by a UKAS accredited notified body

2110F FIRE RESISTING AND SMOKE AND HEAT CONTROL DUCTWORK – FACTORY APPLIED FIRE RESISTING FINISH

Comply with BS EN 12101-7 for Smoke and heat control duct systems.

The design manufacture, installation and testing of the complete fire rated ductwork system shall be undertaken by a specialist.

Ductwork must be capable of resisting the anticipated temperature generated during the development of a fire and the required degree of fire resistance for Integrity & Insulation (BS EN EI nomenclature) as indicated on the tender drawings when tested to the requirements of BS EN 1366 Parts 1, 8 or 9 depending on system function. The ductwork providing either duct type A (fire outside), Duct Type B (fire inside) or Duct Type C (fire inside smoke control duct). All smoke extract ductwork shall be capable of retaining a cross sectional area of 90% under fire conditions in accordance with BS EN 1366- 8 for multi compartment smoke extract systems.

The fire rated ductwork shall be constructed from Galvanised Sheet Steel manufactured to an enhanced standard, then degreased and factory sprayed with the proprietary coating. The coating shall contain selected mineral filters in a low permeability electrometric binder, to give a finished product which has been successfully tested for international use under Cellulosic Fire Conditions in excess of 4 hours duration.

The ductwork shall be composite fire rated ductwork manufactured to method 3 of BS 9999. The ductwork shall be factory produced in flanged sections and assembled on site utilising tested fireproof gaskets. All fire insulation, sealants, gaskets and flexible joints must be non-flammable when tested in accordance with BS EN 1366 Parts 1, 8 & 9. Classification Documents to BS EN 13501-3 & 4 and relevant test documentation to be provided.

After installation the ductwork shall be leakage tested in accordance with DW/143. (to suit pressure classification scheduled)

On kitchen extract systems access doors shall be installed at a minimum distance between doors of 3m.

Where the ductwork passes between fire compartments fire stopping shall be carried out by the specialist in accordance with the ductwork manufacturers recommendations and the ductwork shall be reinforced in line with that used within actual fire test and be relevant to flexible or rigid wall/floor constructions to prevent deformation of the duct in a fire to maintain the cross-sectional area of the duct and ensure that the fire rated penetration seal around the duct is not compromised.

The specialist ductwork contractor shall be responsible for the design and sizing of the drop rods and bearers (and their centres) for the fire rated ductwork to suit the fire duration scheduled.

The internal surface of the ductwork shall be smooth in order to impose no more pressure loss than DW 144 ductwork.

Test holes which are cut in after installation must be suitably sealed by the specialist to ensure that the system integrity is maintained.

The completed system shall be tested to BS EN 1366 Parts 1,8 & 9. Classification Documents required to confirm that systems are suitable for horizontal and vertical applications and in both rectangular and circular profiles

At completion of the project a certificate of conformity shall be issued by the specialist confirming that the system has been manufactured and installed in accordance with the manufacturer's recommendations.

Projects in Non EU markets

Ductwork must be capable of resisting the anticipated temperature generated during the development of a fire and must be tested to BS 476-24, ISO 6944 Fire Rated Ductwork Systems shall be manufactured to provide the required degree of fire resistance (up to 4 hours for stability, integrity and insulation fire ratings) and the type of fire exposure, type A or B.

2120 INTERNAL THERMAL/ACOUSTIC LININGS:

Where indicated line internal surfaces of ducts. Internal lining to be as described in DW/144

Standard: tested and rated in accordance with BS EN ISO 717-1 and relevant parts of BS EN ISO 10140.

Lining

Provide lining that is inert, fire proof, inorganic, vermin proof, non-hygroscopic. Fire rated to Building Control Officers and Fire Officer approval

Material

Class "O" fire rated open cell acoustic foam (minimum 25mm thick required) which shall not emit toxic fumes in the event of a fire.

Performance

Minimum random incidence absorption coefficients in accordance with BS EN ISO 354, as follows:

Frequency (Hz)	125	250	500	1000	2000	4000	8000

0.12	0.21	0.42	0.62	0.68	0.72	

Protection of Lining

Protect lining against product migration and erosion.

Fire resistance: Class O Building Regulations when tested to BS476: Part 6 and Part 7.

2121 EXTERNAL THERMAL/ACOUSTIC INSULATION:

Install required layers of acoustic Insulation, as detailed below, where indicated. (Unless described otherwise in the particular specification)

Material

Duct wrap lamellae glass or mineral wool acoustic insulation.

Polymeric mass layer - 10 kg/m^2

Acoustic performance - Minimum Sound Reduction Index (SRI) – as indicated in particular specification.

Standards: Tested to BS EN ISO 717-1, and relevant parts of BS EN ISO 10140.

Insulation thickness - 50mm

Insulation thermal conductivity - 0.033 – 0.039W/mK at mean temperature of 10°C

Fire resistance - Class 0 Building Regulations when tested to BS 476-6 and BS 476-7

Finish - Reinforced aluminium foil (outer)

Continuous quilted mineral fibre mat .The polymeric mass layer should be positioned outermost from the sound source and overlapped at all joints. The product must be designed to maintain its original thickness subsequent to installation. The lagging should be cut 25mm oversize and a 25mm strip of the inner resilient element removed to create an overlap. The mass layer must not come in contact with the duct.

Overlap and seal all joints with adhesive and external reinforcing tape.

Overlap and seal all joints with adhesive and suitable external reinforcing tape.

Installation -To manufacturer's standard.

2122 ACOUSTIC PLENUMS:

Where indicated

Provide plenums constructed using acoustic panels in positions indicated. Joint panels with seals to match performance of panels. The plenums shall be suitable for the relevant air pressures.

Infill

Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic. Fire rated to Building Control Officers and Fire Officers approval.

Material

Class "O" fire rated open cell acoustic foam (25mm thick required minimum) which shall not give off toxic fumes in the event of fire, unless otherwise indicated.

Performance

Minimum random incidence absorption coefficients in accordance with BS EN 20354, as follows:

Frequency (Hz)	125	250	500	1000	2000	4000	8000
	0.12	0.21	0.42	0.62	0.68	0.72	

2130A PRE-INSULATED THERMAL DUCTWORK (NES 2100M/2130#)

Supply pre-insulated ductwork where indicated or as scheduled.

Material – CFC & HCFC free, closed cell phenolic foam boards

Standards

BS EN 13403

Refer to clauses in section Y50 (thermal insulation) for standards for fire testing / classification.

Thickness - to meet maximum permissible heat loss (warm air ducts) - 16.34 W/m2 and heat gain (chilled/dual-purpose air ducts) - 6.45 W/m2 in accordance with BS 5422 and Non-Domestic Heating, Cooling and Ventilation Compliance Guide, and Approved Document L2A/L2B.

Construction / Installation

Fabrication/Installation in accordance with manufacturer's technical manuals.

CFC and HCFC free phenolic foam panels bonded on both sides to a 28mm micron aluminium foil facing reinforced with a 5mm glass tissue mesh. Minimum density of foam shall be 55kg/m3

The system shall be manufactured and installed by a specialist contractor. The specialist's operatives shall have successfully completed a training course with the manufacturers of the insulated panels . All materials used for the ductwork system shall be approved by the insulated panel manufacturer. Provide internal stiffeners as necessary

All access doors shall be insulated to the same standard as the ductwork and the vapour barrier must be maintained.

Connection to system components shall be by aluminium flanges.

Supports shall be provided at centre not exceeding 3m and at all changes in direction and branch connections. All ductwork ancillaries shall be independently supported.

External Ductwork

All external ductwork shall be provided with a weatherproof finish comprising either 0.7mm thk "Aluzink sheet or a proprietary laminated foil / film introduced during the fabrication of the ductwork.

2141 HANGERS AND SUPPORTS:

Provide hangers and supports throughout in accordance with DW 144; DW 154 Part 5 or DW 191, Section 7 as appropriate. See also clause 4021 for hangers and supports workmanship.

Comply with BS EN 12236.

If a proprietary suspension system is provided it shall comprise channel sections with return lips and compatible fixing accessories made of material to BS EN 10162, BS EN 10210.

Ensure all steel components such as studding, bolts and steel screws, bolts, nuts and washers are either cadmium plated and passivated or zinc electroplated to BS 7371 after manufacture. Do not use metal fixing components likely to deteriorate and/or cause damage

Where a wire rope suspension system is used an alternative to drop rods or studding comply with the following standards:

BS EN 12385-1.
BS EN 13411-3.
BS EN 13411-4.
BSRIA COP 22/2002

2151 SUPPORT OF AIR TERMINAL UNITS:

Support air terminal units and their plenums independently of the ceiling grids, unless otherwise indicated. Hangers shall be adjustable.

3000 ACCESSORIES AND COMPONENTS

3010 CONSTRUCTION AND FINISHES:

Ensure that materials of accessories are compatible with ductwork and that finishes of accessories comply with any special requirements for ductwork. Ensure casing losses of components are compatible with ductwork in which they are incorporated.

3021 ACCESS/INSPECTION OPENINGS:

Provide access openings for inspection/servicing in accordance with DW/144, DW 154 Part 6, section 15 and appendix D table 14 or DW 191 Section 8 as appropriate, and:

Adjacent to all fans
Adjacent to all dampers
As necessary for cleaning purposes

See also clause 3051.

3031 TEST HOLES

Provide test holes in ductwork systems to allow complete testing and balancing of each system in accordance with CIBSE Commissioning Code Series A and BSRIA AG3/89.3:2001. Drill test holes on site in accordance with DW/144.

Provide test holes on each side of all equipment in the system, at least 1.5 duct diameters upstream of all dampers and elsewhere as indicated/specified. Seal all test holes with blind grommets.

Provide at each location the number of test holes shown below:

Circular duct

Duct diam (mm)	No of test holes
Up to 150	1
151 to 450	2
Over 450	4

Rectangular/flat oval ducts

Longest side (mm)	No of test holes
Up to 200	1
201 to 400	2
401 to 600	3

601 to 800	4
801 to 1000	5
1001 to 1200	6
1201 to 1500	7
Over 1500	One per 250mm

3041 HOLES FOR CONTROLS/INSTRUMENTS:
Provide suitably sized and positioned holes in ductwork, in accordance with DW/144 or DW 154 to accommodate all necessary thermostats, humidistats and other control. Holes to be bossed and screwed or drilled as appropriate. Where holes are provided on insulated ductwork, extend to finish flush with insulation.

3042 INSTALLATION OF INSTRUMENTS AND CONTROLS:
Instruments and controls should be installed to manufacturers or specialist supplier's requirements. The installation must be checked by the manufacturer or specialist supplier, and rectified as necessary.

3051 CLEANING ACCESS
Provide access openings for cleaning in accordance with DW/144, TR/19 or DW/154 appendix D as appropriate. In addition, provide access openings such that no point is greater than 5m from an opening. Provide access openings at the top and bottom of every riser.
Refer to BSRIA TN 18/92 for minimum dimensions of access doors.
See also clause 4091.
Where Advanced level of PDI with post installation clean is specified, the specialist cleaning contractor, in addition to taking advantage of openings fitted by the ductwork installer, shall supply and install any additional cleaning openings to suit their selected specific methods of cleaning and suit the practical site conditions relative to the fabric of the building and position of other services.
The specialist cleaning contractor shall select and propose for approval the most appropriate cleaning method from table 8 in TR/19 (section 6.11).

3055 ACCESS/INSPECTION/CLEANING OPENING COVERS
Provide purpose made covers to all access and inspection and cleaning openings. Fit covers with quick release catches. Provide restraining straps. Provide full-face soft neoprene gasket secured to ductwork with adhesive to ensure an air tight seal. Covers shall be capable of withstanding the respective system test pressures.
Any access openings cut in on site shall have the exposed cut edges covered with a protective band.

3056 HINGED ACCESS DOORS
Provide purpose made hinged access doors where indicated in accordance with DW 144. Fit access doors with latch style fastenings. All doors shall be supplied with approved retaining device fixed to door and frame. Access doors shall be capable of withstanding the respective system test. Provide full-face soft neoprene gasket secured to ductwork with adhesive to ensure airtight seal. Provide handles on all access doors.

3058 PRE-INSULATED DOORS AND COVERS:
On all insulated ductwork, provide standard access, inspection and cleaning covers and doors with (minimum) 25 mm thickness of insulation. Doors and covers shall be constructed and installed in such a manner that the internal face of the duct and cover/door is maintained when fixed. On insulated services all access covers/doors shall be fitted with raised stools, which shall be equal to the depth of the insulation.

3061 CONTROL/BALANCING DAMPERS - GENERAL
Dampers shall be provided where indicated on the drawings or called for elsewhere in the specification. Additionally the Contractor shall provide sufficient dampers to regulate and balance the system. Dampers on grilles or diffusers shall be used only for fine and secondary control. All dampers shall be sufficiently rigid to prevent fluttering.
Dampers constructed by the ductwork fabricator shall not be acceptable unless specifically agreed with the Designer in advance.
Dampers shall incorporate a locking device and blade position indication. A sample shall be submitted of the proposed dampers prior to the commencement of the installation.
After final balancing the quadrant shall have a small "V" shaped notch filed in the quadrant indicating the centre line of the lever when in the operating position.

On insulated ducts, the damper actuator quadrant and linkage shall be located proud of the external face of the duct insulation.

As a minimum control / balancing dampers shall be provided at the following locations:

At each fan
At each main branch
At each sub-branch
At any branch serving 3 or more terminals
At each terminal / grille

Where possible dampers on terminals / grilles shall be installed in duct connections rather than with the grille.

3062 CONTROL/BALANCING DAMPERS

Unless otherwise specified, provide extruded aerofoil section, plain opposed blade control and balancing dampers in accordance with DW/144 /or DW/154 Part 6 as appropriate. Manufacturers to confirm that dampers have been aerodynamically tested in accordance with BS EN 1751 and where required determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.
Provide locking device and position indicator on all fu.
Dampers shall be single blade up to 200mm ducting height, elsewhere they shall be multi-blade, opposed blade type with each blade not exceeding 175mm in width and not longer than 1200mm.
Dampers shall be of the aerofoil blade (double skin) multi-leaf opposed blade type (unless otherwise specified) with the blades rigidly fixed to the horizontal spindles.
Each damper gear shall be suitable for operation over the pressure and temperature range of the medium being controlled.
Where dampers are required to operate to a fully closed position, dampers shall be of the low leakage type.
Remote blade operation
Where indicated, supply and install proprietary remote control unit (supplied by the damper manufacturer). Unit to be complete with all necessary brackets and linkage at the control unit. Control unit to provide indication of position of blades. Provide label at the control unit to indicate function.

3063 IRIS DAMPERS:

On final circular runs to and from terminals, provide iris pattern control dampers in accordance with DW/144 or DW/154 as appropriate. Provide each damper with locking device and position indicator.

3064 MOTORISED CONTROL DAMPERS:

Provide control dampers complete with motor, motor linkage and motor support. Motorised dampers shall generally be suitable for 24V on-off reversible motor and shall have a manual override facility.
The Contractor shall ensure they provide the controls specialist with full details of the damper selected and the total operating torque with damper in closed position, to enable the controls specialist to select a suitable actuator or actuators. The exact details of the actuator requirements shall be agreed with specialist controls supplier.
Damper motors, thrusters, positioners and remote operating gear (where required) shall be rigidly mounted on purpose-made brackets and carefully aligned.
Actuators shall have visual position indication and have the capability to provide positive feedback of position to the controls system.

3070A FIRE DAMPER FUSIBLE LINKS:

Supply spare fusible links for fire dampers and combination fire/smoke dampers. Supply ten in total or 1 for every 10 dampers installed (whichever is the greater). Supply links to fuse at temperature indicated

3071 FIRE STOPS - PLASTICS DUCTWORK:

Supply and install fire dampers or intumescent sleeves in accordance with DW154 Part 6 section 17, in accordance with clause 4151

3075 FIRE DAMPERS GENERAL: (NES 3070 & 3075 merged)

Provide fire dampers in accordance with DW/145, relevant parts of DW/144, DW/154 Part 6 paragraph 17 and clause Y30 4151.
Manufacturers to confirm that where required fire dampers have been aerodynamically tested in accordance with BS EN 1751 and where required determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.
Fire-resistance tests of thermal release mechanism in accordance with BS ISO 10294-4.
Types as scheduled: -

Multi-leaf fire dampers

or Intumescent fire dampers . Install in accordance with DW 144, size and location as shown on the drawings.
Fire resistance tests for intumescent dampers shall be in accordance with BS ISO 10294-5.

or Stainless steel shutter fire dampers with shutter blades out of the air stream.

or Multiple "Hit & Miss" steel plates fire damper

or Intumescent sleeves on plastic ductwork up to 350mm dia

Fire dampers shall be supplied and fixed in accordance with the manufacturer's recommendations and installation methods which conform to the prevailing Building Regulations (ADB) and are acceptable to the District Surveyor/Building Control Officer and Fire Officer generally in accordance with DW 145. The proposed installation method must be supported by a valid test report or assessment provided by an approved third party notified body.

The construction shall allow for all additional framing supports, bracing and fire stopping as may be necessary to adequately attach/install the fire dampers to the structure. The assembly is to be approved by the Building Control Officer/District Surveyor and Fire Officer.

Each fire damper and associated installation method shall have at least the same standard of fire integrity as the wall or floor through which the duct passes.
The classification of fire dampers is to be in accordance with BS EN 13501-3 and shall have a minimum integrity classification 'E' to meet that of the wall or floor.

When fire integrity of 4 hours is required, either two dampers (classified E120) factory assembled in series (if acceptable to the local authority) or a single damper having a classification E240 may be used. To achieve these classifications, fire resistance tests shall be in accordance with BS EN 1366-2, undertaken by a notified body.

Shutter dampers shall be provided with the shutter blades located outside the air stream (unless otherwise indicated). Each damper shall have a stainless steel curtain in all-welded galvanized steel casing with stainless steel side seal gaskets. The damper blade curtain shall be held in the folded position by a dual safe thermal actuator and fusible link.

All damper blades shall be tensioned to ensure instantaneous closure on thermal activation at 72^0C (unless specified elsewhere). A self-latching reset mechanism shall be provided for easy re-setting of the damper curtain.
On completion of the installation, the contractor shall be responsible for ensuring the inspection and testing of all fire dampers installed are carried out. Upon completion of the tests, the certificates must be issued for confirming that the dampers have been inspected and that they function correctly in accordance with the manufacturer's data sheets.

Access panels with chains shall be provided adjacent to the access side of all fire dampers.
In no instances shall flexible duct connections be allowed onto fire dampers through walls or floors.
Approved flexible connectors for breakaway joints, or duct expansion in case of fire, may be used in association with fire dampers.
Provide local external visual indication of fire damper blade position, unless indicated otherwise.

3079 SMOKE CONTROL DAMPERS:

Smoke dampers shall comply with DW/145 and relevant parts of DW/144.
Types to be as identified elsewhere in the particular specification, schedules or on drawings. For control requirements refer to Y30sch3, Y30sch4 and work section W60.

Manufacturers to confirm that where required smoke control dampers have been aerodynamically tested in accordance with BS EN 1751 and where required determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.
Smoke dampers shall be supplied and fixed in accordance with the manufacturer's recommendations and installation methods with installation mounting frames which conform to the prevailing Building Regulations (ADB) and are acceptable to the District Surveyor/Building Control Officer and Fire Officer and are generally in accordance with DW 145. The proposed installation method must be supported by a valid test report or assessment provided by an approved third party notified body.

The construction shall allow for all additional framing supports, bracing and fire stopping as may be necessary to adequately attach/install the smoke dampers to the structure. The assembly is to be approved by the Building Control Officer/District Surveyor and Fire Officer.
Smoke control dampers to be in accordance with BS EN 12101-8, tested for fire resistance to BS EN 1366-10 and classified in accordance with BS EN 13501-4.

Smoke control dampers placed on the market and intended to operate as part of a pressure differential system or smoke and heat control system to be in accordance with BS EN 12101-8.

Smoke dampers shall be of the single blade or multi-blade type as indicated elsewhere in this specification. Damper blades shall be mechanically connected to an actuator to hold the blades in either the open or closed position dependent on the control mode chosen.

On completion of the installation, the contractor shall be responsible for ensuring the inspection and testing of all smoke dampers installed are carried out. Upon completion of the tests, the certificates must be issued for conforming that the dampers have been inspected and that they function correctly in accordance with the manufacturer's data sheets.

Access panels with chains shall be provided adjacent to the access side of all smoke dampers (additional access may be required for cleaning purposes and should be supplied if necessary).
In no instances shall flexible duct connections be allowed through walls or floors. Approved flexible connectors for breakaway joints, or duct expansion in case of fire, may be used in association with smoke dampers.

Provide local external visual indication of smoke damper blade position, unless indicated otherwise.

Where scheduled, provide a knee type interlocking opposed blade design mechanism to the dampers to prevent the blades from being re-opened due to air pressure and ensure the damper does not rely on the actuator to hold the blades closed. When fitted with an actuator with failsafe close, the damper blades will close and the damper only opens again if the power is restored to actuator or if the actuator has an override hand operation.

3089 COMBINATION FIRE/SMOKE CONTROL DAMPERS

Installation of Combination fire/smoke dampers shall comply with DW/145 and relevant parts of DW/144.
Manufacturers to confirm that where required smoke control dampers have been aerodynamically tested in accordance with BS EN 1751 and where required determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.
Types to be as identified elsewhere in the particular specification, schedules or on drawings. For control requirements refer to Y30sch3, Y30sch4 and work section W60.
Combination smoke and fire dampers shall be supplied and fixed in accordance with the manufacturer's recommendations and installation methods which conform to the prevailing Building Regulations (ADB) and are acceptable to the District Surveyor/Building Control Officer generally in accordance with DW/145. The proposed installation method must be supported by a valid test report or assessment provided by an approved third party notified body.
The construction shall allow for all additional framing supports, bracing and fire stopping as may be necessary to adequately attach/install the fire dampers to the structure. The assembly is to be approved by the Building Control Officer/District Surveyor and Fire Officer.
Each combination smoke and fire damper and associated installation method shall have at least the same standard of fire integrity as the wall or floor through which the duct passes.

The classification of combination fire and smoke dampers is to be in accordance with BS EN 13501-4 and shall have an integrity classification 'E' to meet that of the wall or floor supported

When a fire integrity of 4 hours is required, either two dampers (classified E120, ES60 (min) factory assembled in series (if acceptable to the local authority) or a single damper having a classification E240, ES60 (min), may be used.
To achieve these classifications, fire resistance tests shall be in accordance with BS EN 1366-2 and BS EN 1366-10 undertaken by a notified body.
Combination fire and smoke dampers tested ad-hoc to BS 476-20 and BS 476-22 shall be permitted only under conditions where the Building Regulations (ADB) specifically allow. This requirement shall be confirmed before supplying such tested product.

Combination smoke and fire dampers shall be of the single blade or multi blade type as indicated elsewhere in this specification. Damper blades shall be released from their open position by means of either a thermal release device rated at a temperature indicated elsewhere in this specification, or via a mechanical actuator connected to a smoke alarm or control system, or a combination of both dependent on the control mode selected as scheduled.
On completion of the installation, the contractor shall be responsible for ensuring the inspection and testing of all combination smoke and fire dampers installed are carried out. Upon completion of the tests, the certificates must be issued for conforming that the dampers have been inspected and that they function correctly in accordance with the manufacturer's data sheets.
Access panels with chains shall be provided adjacent to the access side of all combination smoke and fire dampers.
In no instances shall flexible duct connections be allowed through walls or floors. Approved flexible connectors for breakaway joints, or duct expansion in case of fire, may be used in association with combination smoke and fire dampers.
Provide local external visual indication of combination smoke and fire damper blade position, unless indicated otherwise.
Where scheduled, provide a knee type interlocking opposed blade design mechanism to the dampers to prevent the blades from being re-opened due to air pressure and ensure the damper does not rely on the actuator to hold the blades closed. When fitted with an actuator with failsafe close, the damper blades will close and the damper only opens again if the power is restored to actuator or if the actuator has an override hand operation.

3092 PRESSURE CONTROL FLAPS, STAINLESS STEEL FRAMES:
Supply pressure control flaps as indicated on drawings or as scheduled. Supply flap and adjustable balance weight assembly manufactured from stainless steel. Construct wall mounting casings from stainless steel or nylon coated mild steel unless otherwise indicated.
Set the balance weight assembly on flap to control at pressure required.

3093 WALL MOUNTED PRESSURE RELIEF DAMPERS:
Provide wall mounted dampers with subframe. Supply frames made from galvanised sheet steel and blades made from aluminium unless otherwise indicated.

3094 DOOR MOUNTED PRESSURE RELIEF DAMPERS:
Provide door mounted dampers with subframe. Supply frames made from extruded aluminium section with aluminium or PVC blades unless otherwise indicated.

3095 SHUT OFF DAMPERS:
Supply shut off dampers to give shut off of 100%.
Manufacture from sheet steel coated with polyurethane lacquer, suitable for either pneumatic, electro-pneumatic or electric/electronic control as required by the control system.

3096 NON RETURN DAMPER:
Supply non-return dampers where indicated/specified. Manufacture with galvanised sheet steel frame and aluminium blades.

3101 FLEXIBLE DUCTWORK: (NES 3100 & 4015 merged)

Supply flexible ductwork, insulated to same standard as used for the main distribution ductwork in accordance with DW/144. Installation to comply with BSRIA Guide BG43 - Flexible ductwork.
Material - Aluminium/Polyester laminate encapsulating high tensile steel wire helix.
Insulated ducts to have inner core of aluminium/Polyester laminate encapsulating high tensile steel wire helix, with mineral wool insulation and an outer core of aluminium and polyester laminate. Insulation
Building Control and Fire Officer Approvals shall be obtained for the use of the flexible ductwork to be installed.
Comply with BS EN 13180 and provide a test certificate proving compliance with the mechanical characteristics of this standard.
Flexible ductwork used to make final connection between distribution ductwork and terminal units and from terminal devices to supply grilles, it must be kept as short and straight as possible and shall not be used to take up gross misalignment. Maximum length of flex to be three diameters or 1m, whichever is the smaller.
Where the flexible ductwork is to be insulated, this shall be Class "O" fire rated.
The maximum frictional resistance to airflow per unit length of the flexible duct shall be agreed with the Designer. The radius ratio R/D for bends shall not be less than 2 where R is the centre line radius and D is the diameter of the flexible duct.
The flexible ductwork shall be to a standard of air tightness equal to that of the ductwork, and constructed to meet the fire precautions recommended in BS 9999 which comprise:-
Ductwork and insulation to have a test certificate proving reaction to fire performance requirements of BS 9999. Materials to conform to Euroclass A1 as specified in BS EN 13501 or when tested to BS 476-6 has a fire propagation index of not more than 12 and a sub-index of not more than 6.
Materials shall not produce smoke or toxic fume hazards if involved in a fire.
Support rings to be sized so as not to constrict the cross-sectional area of the ductwork. Duct support ring minimum width – 25mm.
Flexible ducts to overlap rigid duct or terminal device spigot by a minimum of 50mm
Make a seal between flexible duct and rigid connection using mastic sealant or duct tape.
Use a mechanical fixing for connection using a duct band.

3111 FLEXIBLE JOINT CONNECTIONS

Supply and install flexible joints as detailed in relevant parts of DW 144 or DW 154 as appropriate. Comply with relevant parts of BS 476.
All flexible joint connections shall comply with current Building Regulations regarding the spread of fire and smoke.
Position

Use flexible joints to make connections to:

Air diffusers, grilles and air registers,
On inlet and outlet connections to all fans or fan and attenuator assemblies,
At building movement joints, and
Elsewhere as indicated/specified.

On fans;

Flexible joints on fan connections shall be between flanged ends. The flexible material flange shall be backed by an angle or flat iron flange and the flexible joints shall be secured held between the metal flanges. Flat iron bands used with fan inlets shall be not less than 5 mm thick.
Flexible joints shall be equal in cross-section to the points of connection, not longer than 250 mm or less than 50 mm.

Properties

Flexible joints shall be "Neoprene" coated glass fibre or other materials excluding asbestos and have fire resistance properties of 30 minutes integrity. Class 1 surface spread of flame to BS 476: Part 7 and not produce smoke or toxic fume hazards if involved in a fire.

3120 BIRD WIRE GUARDS:

Fit bird screens of 12mm square mesh wire on all intake and extract louvres to atmosphere. Wire gauge to be not less than 1mm.
Finish, plastic coated wire.

3130 INSECT GUARDS:

Provide insect guards where indicated scheduled.
Screens to be supplied in kit form for installation on site.

Material: Black PVC coated glass fibre mesh
Aperture size: 1.1x1.55mm
Weight: 155 g/m2
Free area: 62%

3132 SPREADER PLATE:
Provide duct mounted perforated inlet plate to humidifier sections to equalize air velocity over humidifier section.

3131 SEALANTS GASKETS AND TAPES:
For sealing materials and method of use comply with DW 144 Section 8 or DW 154 section 8 as appropriate. Gaskets or performed strips must be of an equivalent width to the faces of joint flanges. The use of self-adhesive tapes shall not be permitted. On circular ductwork chemical reaction sealing tapes may be used with the Designer's prior agreement. Sealants, gaskets and tapes shall be constructed using WRC approved sealants, gaskets, joints, adhesives etc, which will not support bacterial growth and which produce minimal fire or smoke hazards if involved in a fire, this to include attachments such as grilles etc.

3132 SPLITTERS:
Do not use splitters without obtaining written consent or unless the use of splitters is specifically specified. Construct splitters in same gauge and material as enclosing ductwork and attach to duct as described in DW 144 Part 3.

3133 TURNING VANES
Use square bends with turning vanes in all cases for flat, oval and rectangular ductwork unless otherwise agreed in writing.

3135A TURNING VANES-LOW AND MEDIUM PRESSURE
Provide double skin aerofoil pattern turning vanes in low and medium pressure ductwork. Construct vanes from material similar to enclosing ductwork. Fasten turning vanes as described in DW 144 Part 3.

3135B TURNING VANES-HIGH PRESSURE:
Provide turning vanes of double skin aerofoil pattern in high-pressure ductwork, constructed from material similar to enclosing ductwork. Fasten turning vanes as described in DW 144 Part 3.

3141 PRESSURE CONTROL FLAPS (Air pressure control valves)
Supply pressure control flaps with flap and adjustable balance weight assembly manufactured from stainless steel. Construct wall mounting casings from stainless steel. Blades to pivot on sealed for life ball bearings.
Set the balance weight assembly on flap to control at pressure as indicated.

3151 PRESSURE RELIEF DAMPERS:
Wall mounted dampers with subframe.
Material
Supply frames made from Extruded aluminium section.
Supply blades made from Grade 304 stainless steel

3161 SHUT OFF DAMPER:
Supply shut off dampers to give shut off of 100%
Frame manufactured from galvanized sheet steel, blades to be double skin stainless steel with synthetic leading and trailing edge seals and double side seals suitable for electric/electronic control.

3171 NON RETURN DAMPER:
Supply non return dampers manufactured with galvanized sheet steel frame or aluminium alloy extrusions and aluminium blades supported on plastic moulded bearing surfaces

Ensure non return dampers in smoke handling systems have the required stability and integrity rating to match the system requirements.

4000 WORKMANSHIP

4011 GENERAL WORKMANSHIP:

Install ductwork in accordance with DW 144, DW 154 and DW 191 as appropriate. Ensure that there are no sharp edges or corners on cut edges on ductwork, flanges and supports.

Unless indicated otherwise, the outermost surface of exposed ductwork or insulation shall be not less than 100mm away from walls and ceilings to permit access for cleaning.

Ductwork shall be constructed such that all internal surfaces are generally smooth and will not normally retain moisture.

Ductwork shall be run generally parallel with walls and ceilings in order to circumvent building projections (or pass through structures where permitted) as shown on the drawings.

Internal roughness and obstruction to airflow (other than dampers, vanes etc) or sharp edges of corners on the outside of ductwork, flange supports etc shall not be accepted.

Weatherproof collars shall be provided where roofs or external walls are penetrated.

Attention shall be paid to the making and sealing of joints in ductwork, particularly where these occur on the blind side of a duct or are subsequently obscured by other parts of an installation or building fabric etc.

Install pre-insulated ductwork in accordance with manufacturer's instructions.

4015 PROTECTIVE FINISHES:

Comply with DW 144 for provision of protective finishes to ductwork. Make good welding damage..
Paint all bare edges and bare metal with two coats of zinc rich paint.
Provide any other special finishes as defined.

4021 HANGERS AND SUPPORTS WORKMANSHIP:

Support ductwork in accordance with DW 144, DW 154 Part 5; or DW 191 as appropriate.
Where insulation of ductwork is specified, install supports to ensure that the insulation can be easily applied and (where applicable) that integrity of vapour seal can be maintained. When installing vapour seal insulation blocks at supports, ensure there is complete vapour seal around the block prior to fixing the bracket. Blocks shall be the same thickness as the insulation and be of sufficient length either side of the support so as to enable vapour sealing on to the block. (Vapour sealing must not incorporate the bracket).

The Contractor shall purpose design supports for diagonally or vertically run ducting or shafts and other particular applications.

Where ducts or shafts are outside buildings or protective enclosures, and Local Authority regulations apply -

a) Submit detailed fabrication drawings to the Local Authority.
b) Obtain written evidence of Local Authority approval.
c) Submit drawings and evidence of approval to the Designer.

Where cantilever brackets or other special forms of support are required they shall be structurally strong enough to take the load and to transfer the imposed load to the building structure. Provide details of the loads imposed on the structure to the Structural Engineer.

The ductwork hangers shall be galvanised, adjustable and have, between the hanger and the ductwork, a gasket to prevent metal to metal contact.

Shot fired fixings shall not be permitted.

Bright zinc plated drop rods, nuts, bolts and washers shall be used on all supports.

All bearers shall be galvanised or zinc rich finish.

Two piece band clips, galvanised or zinc rich finish shall be used on circular ducts. Fig 65 (with drop rod) shall be used wherever applicable.

Flat oval ductwork – only Fig No 71 shall be permitted. Galvanised or zinc rich finish shall be used.

After all installation work is complete, cut back drop rods to ensure that projection through bottom bearer does not exceed twice the thickness of the securing nut.

On all cold services (i.e. below 15 degC), a vapour seal is required (including air inlets and downstream of heat reclaim coils). Ensure continuity of vapour barrier over ductwork support.

4022 APPEARANCE OF DUCTWORK SUPPORTS:
Cut off protruding ends of hanger rods and bolts close to nuts. Ensure that supports and drop rods are clear of ducts and not enclosed in thermal insulation, as DW 144 Section 19.6.

4023 PROPRIETARY SUPPORTS:
Use proprietary system of ductwork supports as appropriate. Obtain prior agreement from Designer of system to be used.

4025 COMPONENT SUPPORT ON PRE-INSULATED ALUMINIUM DUCTWORK:
Support ducts with dimensions less than 1m at intervals of no more than 4m. Support ducts with dimensions over 1m at intervals of no more than 2m. Provide independent support for all accessories.

4041 EXTERNAL DUCTWORK AND SUPPORTS:
Comply with BESA DW 144 section 26 protected from the elements by a watertight membrane installed immediately after the ductwork has been installed unless scheduled otherwise.
Where all welded construction is required (as scheduled), use black mild steel sheet, galvanised after manufacture as BESA DW144 Appendix C.
All welded external ductwork shall be constructed from mild sheet and sections, minimum thickness 1.6mm and shall be galvanised after manufacture. All ductwork shall be flanged and all nuts, bolts and fixings shall be bright zinc plated.

All supports shall also be constructed from mild steel sections and shall be galvanised after manufacture. Submit proposals to Designer and Structural engineer for comment.
Particular care shall be taken in selecting structural fixings that will provide a life cycle appropriate to the buildings intended use. All supports and fixings shall comply with Local Authority requirements. Obtain approval from the Local Authority where required.

4050 DUCTWORK FLOOR SUPPORT
Submit proposals to Designers for comment.

4054 AIRWAY OBSTRUCTIONS
Fit and secure rigid sheet metal fairings which are shaped to form rounded leading edges on the 'Upstream' ends, and tapered trailing edges on the 'Downstream' ends of obstruction.

4055 DUCTWORK VIBRATION ISOLATION
Ensure that ductwork does not come in direct contact with building fabric except in cases of fire dampers, silencers and builders frames. Isolate all supporting members/bearers from ductwork; secure lining of 6mm thick rubber, PVC or felt strip to support by means of adhesive.

4056 ACCESSORY SUPPORT:
In accordance with DW 144 Part 6 for supporting ductwork ancillaries. Submit details of supports to Designer for agreement.
Provide additional supports adjacent to dampers, diffusers and other items of equipment as necessary to prevent distortion.

4061 DRAINAGE OF DUCTWORK:
Arrange ductwork to drain any entrained moisture and ensure the lapping of joints prevents moisture leakage.

4071 CONNECTIONS:

Plant connections

Make connection between air handling assembly and ductwork system in accordance with DW 144 and manufacturers recommendations.

Connections to building openings

Comply with DW 144 Appendix K or DW 154 Part 6 as appropriate.

4080 EXPANSION JOINTS - PLASTIC DUCTS:

Provide expansion joints in accordance with DW 154

4091 INTERNAL CLEANLINESS:

Provide the level of care and protection as defined in BESA document TR/19, level as scheduled. Where level is not otherwise specified or scheduled, supply and recirculation systems are to be Advanced PDI level; extract systems are to be Intermediate PDI level.

Seal all open ends as installation proceeds by caps or blank flanges, to prevent ingress of foreign matter.

Cap material

Metal.

or Plastic.

Unless scheduled otherwise for installations to Advanced PDI level (and elsewhere as specified), all ductwork shall be thoroughly cleaned immediately prior to handover in accordance with TR/19 2013, using dry vacuum cleaners or a combination of the methods outlined in table 8 in TR/19 to ensure that no traces of dust, dirt or other foreign matter are present in the systems. To facilitate this requirement, provide cleaning access openings and covers in ductwork at intervals such that no point in the ductwork is more than 5 metres from an opening and elsewhere as required by TR/19. The location of the openings shall be selected by the contractor. Confirmation of the acceptability of the solution shall be obtained from a specialist cleaning contractor.

Comply with TR/19 section 7 and DW/172 in relation to kitchen extract systems.

4092 WET METHOD OF CLEANING:

Where specifically scheduled, the method of cleaning in accordance with the BESA Guide TR/19 - Wet cleaning, Table 8 shall be used.

The system should be thoroughly dried prior to commissioning/de-commissioning to prevent moisture assisting in the growth of micro-organisms.

A risk assessment must be carried out before any cleaning chemicals or biocides are considered. The details of any such chemicals or biocides must be recorded and any adverse effects of the applied chemicals assessed and determined, with appropriate safe procedures set out in a formal method statement.

Steam cleaning and high pressure waterwash are not recommended for ductwork that is situated above ceilings or in sensitive areas unless carried out in a controlled manner to contain leakage. Procedures to take account of operative safety must be adopted, and should be set out in written form.

Careful consideration should be given to the use of chemicals and/or water for surfaces that are porous e.g. internally-lined ductwork, attenuators, fibre board ductwork, attenuators, fibre board ductwork etc., to prevent permanent damage.

Before applying wet cleaning methods care should be taken that condensed vapours and cleaning fluids can be removed from the ductwork system.

4101 WEATHERPROOFING

Fit ductwork with trimming angle and weather cravat, skirt, flashing plate and cowl where ductwork passes through or terminates in roof, to ensure a weatherproof seal to building structure.

4111 DUCTWORK SLEEVES:

Enclose ducts passing through building elements, (walls, floors, partitions, etc.) within purpose made sleeves. Cut sleeves of the same material as the duct and pack with mineral fibre or similar non-flammable and fire resistant material to form a fire/smoke stop of adequate rating and to prevent air movement and noise transmission between duct and sleeve.

Provide enclosing flanges on either side of wall where ductwork is exposed in rooms. Fix enclosing flanges back to wall to give a neat appearance.
Where finished insulation is carried through duct sleeves pack space between insulation finish and sleeve to form fire stop.

4121 FIRE RATED DUCTWORK SLEEVES:
Ensure fire rated ductwork sleeves, when required, are installed to the manufacturer's requirements.

4125 EXPANSION AND CONTRACTION
When installing long runs of air ducting, give attention to the direction of expansion or contraction movement due to thermal changes. Take up movement by flexible inserts.

4127 MOVEMENT AND NOISE
Prevent undue ducting movement, with consequent noise, by separating metallic contact surfaces with packing material, and interpose auxiliary flexible joints and anchoring supports along with ducting runs.

4131 INSTALLATION OF CONTROL EQUIPMENT
Fit sensors, damper motors and other control equipment as required. All control equipment should be installed to manufacturers or specialist supplier's requirements. The installation must be checked by the manufacturer or specialist supplier, and rectified as necessary

4141 INSTRUMENT CONNECTIONS:
Provide instrument connections as necessary.

4151 FIRE PRECAUTIONS:
Install fire dampers, smoke dampers and fire/smoke dampers as necessary to meet the fire compartmentation of the project. Refer to architects drawings for fire compartmentation.

4160 DAMPER ACCESS:
Ensure access is provided to damper mechanisms on fire dampers; smoke dampers; combined smoke and fire dampers; and volume control dampers through access doors, false ceilings etc.
Demonstrate that damper blades close completely.

Demonstrate that fire links can be replaced. Where more than one fire damper is installed in a frame ensure access is provided to all fire dampers.

4171 POSITIONING:
Position components in accordance with manufacturer's instructions as shown on the manufacturer's drawings or specialist supplier's drawings or specialist contractor's drawings as appropriate.

4181 FLEXIBLE DUCTWORK, WIRE LOOP TIES:
Ensure that flexible ductwork does not become kinked or flattened. Support flexible ductwork using wire loop tie supports to prevent sagging.

10000 Based on NES Y30 TEXT Dec 19

Y41 -Fan

1000 GENERAL

Standards

Provide fans manufactured and tested in accordance with appropriate British Standards.
With regard to safety requirements, comply with BS EN 60335-2-80 where applicable.
Fans for smoke and heat control to be in accordance with BS EN 12101-3
Fans for use in potentially explosive atmospheres / flameproof zones to be in accordance with BS EN 14986 and relevant parts of BS EN 13463 or BS EN ISO 80079 and relevant parts of BS EN IEC 60079 / BS EN 60079 series and be compliant with the ATEX directive.
Inline and chimney outlet exhaust fans to comply with BS EN 16475-2
Kitchen extract fans to comply with BESA DW / 172.

Fans driven by electric motors with electric input between 125W and 500kW should comply with EC Regulation 327/2011 with regard to ecodesign requirements.
Comply with EU regulation 1253/2014 for small packaged ventilation units comprising fan(s), heat recovery system, filters and controls (or a combination of these components) up to 1000m^3/hr with regard to ecodesign requirements.

1005 APPROVED FIRMS:

Select fans from Quality Assured firms registered under CAME scheme, unless otherwise indicated.

1011 DESIGN DUTIES:

Air Volume

Ensure scheduled volume is provided when operating against resistance of system corrected for changes between specified and selected component resistances.

System Resistance

Adjust scheduled resistance to compensate for actual resistance of selected components and any changes made by the contractor to the ductwork layout, quantities and types of bends etc from that indicated on the tender drawings

Operating Point

Select operating point on pressure/volume curve to provide stable and efficient operation. Fans shall be selected to give the lowest possible noise rating having regard to their duty and type.
Whenever possible the fan supplier shall select fans over the range of air flows where the efficiency is not less than 85 % of the optimum efficiency in accordance with Annex E in BS EN ISO 12759.

Guaranteed Performance

Provide fan performance figures in accordance with:
BS EN ISO 5801 for all types except those designed solely for air circulation.
BS 848-9, ISO 13348 for tolerances, methods of conversion and technical data presentation.
BS EN ISO 13350 for testing of jet fans.

Quoted fan duties are based on pressure losses external to the fan unit and on the equipment air side pressure losses as scheduled in Y41sch.
Before ordering the fans, the contractor shall adjust the fan static pressures to suit pressure drops of actual components used in the systems
Adjust fan heads if changes are made to ductwork routing or arrangement in preparation of installation drawings or details.
Quoted fan duties include the following commissioning allowances:-

	Low Pressure Systems	Medium & High Pressure Systems
On Flow Rates	10 %	5%
On Head	20%	15%

Allow for a pulley and belt change on belt driven fans and impeller change or angle adjustment on direct drive fans.

1020 PROTECTION:

Protect casings, impellers and shafts against corrosion. Protect bearings against dirt and moisture.

1061 FAN MOTORS

Comply with reference section Y92 clauses.

1065 FAN MOTOR STARTERS

Incorporated in Controls - reference W60.
Comply with reference section Y72 clauses.
Fit variable speed drives to all fans rated at more than 1.1kW and as scheduled.

2000 PRODUCTS/MATERIALS

2010A OPERATING CONDITIONS:

Installation arrangement as shown on drawings.
Configuration

Parallel or series operation as shown on drawings.

Sound Power Level

Select fan, motor, drive and speed control system not to exceed sound power levels or sound pressure levels scheduled or specified elsewhere. Provide sound power data in accordance with BS EN ISO 5136 and parts 1-4 of BS ISO 13347

Select plant that does not have a distinguishable, discrete, continuous noise or give rise to distinct impulses.

Air Density

Relate fan performance to air density 1.20kg/m3.

Temperature Range

Minimum to maximum operating temperatures –10°C to 40°C or as scheduled / indicated.

2010B POTENTIALLY EXPLOSIVE ATMOSPHERES

Constructional requirements:
The constructional requirements for fans constructed to Group IIG (of explosion groups IIA, IIB and hydrogen) categories 1, 2 and 3, and Group IID categories 2 and 3, intended for use in explosive atmospheres shall be in accordance with BS EN 14986 and relevant parts of BS EN IEC 60079 / BS EN 60079 and BS EN ISO 80079.
Ambient atmosphere pressure:
Absolute pressure ranging from 0.8bar to 1.1bar.
Temperature range:
Minimum to maximum operating temperatures of -20^{0}C to 60^{0}C inlet gas temperature, -10% to +20% of nominal gas flow.

2020A CONSTRUCTION AND HANDLING:

Casings

Construct rigid casing free from drumming under operating conditions.
Flange dimensions to BS EN ISO 13351
Supply in sections as required for access or handling.

Safety Standards

BS EN 60335 – 2 – 80 for the safety of electric fans for household and similar
Purposes.
BS EN ISO 12499 – for guarding

Rotating assemblies

Balance in accordance with relevant parts of BS ISO 21940.

Shafts and hubs

Machine impeller bosses and shafts to BS 4500 and key in accordance with BS 4235-1. Hold impeller to shaft with set screw or taper lock fitting.

Shaft bearings - Sealed for life.
Drives and guards

Provide guards over shaft, couplings and rope in accordance with BS EN ISO 12100 for general principles of design and HSE requirements.
Material - galvanized or sheet steel.

Lifting

Provide lifting eyebolts or similar facilities on fans or sections heavier than 20kg.

2031 TESTING:

Provide results of aerodynamic performance tests in accordance with BS EN ISO 5801, BS 848-1; noise tests in accordance with parts 1-4 of BS ISO 13347 and /or BS EN ISO 5136 as appropriate and fan balancing and vibration measurements in accordance with BS ISO 14695, BS 848-6.

The minimum energy efficiency requirements for fans driven by electric motors with electric input between 125W and 500kW should comply with EC Regulation 327/2011.

2050A MATERIALS - GALVANISED SHEET STEEL:

Construct casing from galvanised sheet steel in accordance with BS EN 1S0 1461, BS EN 10326, BS EN 10327.or BS EN 10143 unless scheduled otherwise.

2060z MOTOR:

Speed

Single, two or variable speed, as indicated.

Standards

Where variable speed drives are fitted to direct drive fans, ensure the drive meets the safety requirements of BS EN 61800-5-1. Comply with Y72 and Y92 clauses

Options:

When fan is handling saturated or corrosive air, provide motor ventilation to clean air,

2065 DRIVE / COMMISSIONING ALLOWANCES:

Direct, or belt driven as scheduled.

Provide belt driven fans with two or more belts. Belt drives shall comply with BS 3790.

For each belt driven fan provide a change of belts and drives (to be sized after balancing the system). Allow for changing belts and drives and recommissioning fan and rechecking system as necessary.

For each direct drive, adjustable pitch, axial fan, allow for a change of pitch angle (to be determined after balancing the system). Allow for recommissioning each system after the fan blade pitch change.

Refer to schedules for commissioning allowances included in duties.

2070A AXIAL FLOW FANS:

Fan impeller and casing aerodynamic efficiency

Manufacturer's standard to achieve overall efficiency of the fan, motor and drive combination scheduled or detailed elsewhere in the project particular specification.

Operation

Single; two in series; or multi-stage contra- rotating as indicated.

Bearings

Provide bearings suitable for mounting and direction of flow as shown on drawings.

Impellers

Fixed pitch; or adjustable pitch as indicated.

Casing - enclosing impeller and motor.

2080A SINGLE INLET SINGLE WIDTH CENTRIFUGAL FANS:

Fan impeller and casing aerodynamic efficiency

Manufacturer's standard to achieve overall efficiency of the fan, motor and drive combination scheduled or detailed elsewhere in the project particular specification.

Operation - single.

Impeller Design

Supply fan with impeller to suit operating conditions indicated.

Casing - single inlet single width.

Mounting - channel frame.

Drain

Fit drain connection at lowest point of scroll as indicated.

2080C DOUBLE INLET DOUBLE WIDTH CENTRIFUGAL FANS:

Fan impeller and casing aerodynamic efficiency

Manufacturer's standard to achieve overall efficiency of the fan, motor and drive combination scheduled or detailed elsewhere in the project particular specification.

Operation - single.

Impeller Design

Supply fan with impeller to suit operating conditions indicated.
Casing - double inlet double width.
Mounting - channel frame.
Drain
Fit drain connection at lowest point of scroll where as indicated

2090A PROPELLER FANS:
Fan impeller and casing aerodynamic efficiency
Manufacturer's standard to achieve overall efficiency of the fan, motor and drive combination scheduled or detailed elsewhere in the project particular specification.
Drives
When motor spindle is extended for mounting blade hub, connect motor to casing, diaphragm plate or mounting ring with support arms.
Impellers
Supply profile blades designed to give uniform airflow.
Mountings
Support fans on plate with circular opening sized and
Located in accordance with fan manufacturer's requirements.

2100A MIXED FLOW FANS:
Fan impeller and casing aerodynamic efficiency
Manufacturer's standard to achieve overall efficiency of the fan, motor and drive combination scheduled or detailed elsewhere in the project particular specification.
Operation - single.
Provide bearings suitable for mounting and position indicated on drawings.

2200z CONSTRUCTION OF SMOKE EXTRACT FANS AND NATURAL VENTILATORS (U14 300.021):
Ensure smoke extract fans and ventilators are constructed so that when in use no flames or hot gases are deflected directly onto an adjacent structure.
Ensure materials used in the construction of the smoke extract fans and ventilators do not add to the fire risk of the building, nor contribute to a fire during use.
Construct smoke extract fans and ventilators from material defined in BS 476-4 as non-combustible. Ensure smoke extract fans and ventilators with insulation material, plastic louvres, flaps, sheets or slopes have a Class 1 spread of flame rating when tested in accordance with BS 476-7 and are classified as `does not readily sustain ignition' to BS 476-12.
Powered smoke and heat exhaust ventilators (fans) shall comply with BS EN 12101-3.

3000 ACCESSORIES

3010 INSPECTION DOORS - AXIAL FANS:
Fit air-tight inspection doors giving access to drive motors and other components requiring regular servicing or maintenance.

3020 INSPECTION DOORS - CENTRIFUGAL FANS:
Fit air-tight doors in scroll and cover.

3030 INSPECTION DOORS - PROPELLER FANS:
For diaphragm mounted fans fit an air-tight inspection door positioned to give access to drive, or other sub-components requiring regular servicing or maintenance.

3040 INSPECTION DOORS - MIXED FLOW FANS:
Fit air-tight doors giving access to drive motors and other components requiring regular servicing or maintenance.

3041 ACCESS PANELS – KITCHEN EXTRACT FANS
Access panels fitted to the casing shall be the full width of the impeller and located to facilitate cleaning and maintenance.

Y41 -Fan

3050A GUARDS:
Provide guards in accordance with BS EN ISO 121000.
Fit safety guards on air inlet and air outlet connections where these are freely accessible to personnel in accordance with BS EN ISO 12449, BS 848-5.
Provide bird guards unless fans are protected elsewhere (eg by birdguards at louvres).

3060z CONNECTIONS TO DUCT:
Provide flexible connections unless otherwise indicated.

3070A GUIDE VANES - AXIAL FANS:
Supply fan with integral downstream guide vanes. Or guide vane unit fitted upstream, or as otherwise indicated.

3080 GUIDE VANES - CENTRIFUGAL FANS:
Fit automatically controlled inlet guide vanes to inlet of fan.
Provide an actuating device for each set of inlet guide vanes.

3090 GUIDE VANES - MIXED FLOW FANS:
Fit automatically controlled guide vanes.

3100z SHUTTERS:
Fit shutters to prevent reverse flow through fan.
Back draft shutters or motorized shutters as indicated.

3110 AIR FLOW SENSORS:
Fit air flow sensors on twin fan units to sense fan failure and provide automatic changeover to standby fan.

3120 ACCESS:
Provide access via hinged casing or as otherwise indicated.

3141 SPEED CONTROLLER:
Where provided, ensure speed controllers are matched to fans.

3150 STANDBY MOTOR:
Provide standby motor as indicated.

4000 WORKMANSHIP

4010 LOCATION:
Install fans in positions indicated, in accordance with manufacturer's instructions and recommendations in CIBSE TM 42 Fan Application Guide.

4020 ATTITUDE:
Mount impeller shaft horizontally unless otherwise indicated.

4030 ALIGNMENT:
Ensure fan is installed aligned to allow optimum air flow path.

4040 TESTING:
Ensure fan is isolated from installation during air leakage testing of ductwork.

4051 DRAIN CONNECTION:
Fit trap to drain connection at lowest point of scroll on centrifugal fans unless otherwise indicated.

10000 Based on NES Y41text Dec 19

Y45 – Silencers & Acoustic Treatment

1012 DESIGN DUTIES:

Supply equipment to meet dynamic insertion losses or acoustic performance indicated with resistance to air flow as indicated with any specific requirements or limitations as indicated.

Note: Plastic films used to protect infill from moisture or grease ingress may reduce the acoustic performance. Where this method of protection is employed, due allowance shall be made for any loss of performance when selecting equipment to meet the specific insertion loss or acoustic performance.

1020z TESTING:

Manufacturers shall provide certified insertion loss data as defined and derived in tests to BS EN ISO 7235, for each of the eight octave bands.

Generated sound power levels in dB (re 10^{-12}Watts) shall also be provided along with certified insertion loss data for each silencer duty.

Where equipment is manufactured in modules, the performance ratings shall apply to the unit as a whole.

1030z PROTECTION:

Where silencers are to be exposed to external weather conditions, their inner and outer surfaces shall be protected in accordance with the relevant ductwork specification.

Silencers are to be delivered to site with blocked ends to prevent damage.

Provide suitable bracing and restraint, for both transportation and storage, to maintain acoustic and physical integrity.

1040 DIRECTION OF FLOW:

Clearly mark direction of air-flow on silencers.

2000 PRODUCT/MATERIALS:

2010z FIRE PROPERTIES:

Use non-flammable adhesives. Ensure that all insulating materials and coverings are non-combustible material covered with a material that complies with flame spread requirements of BS 476 - 7, Class 1 or Class 0 as required by Building Control/Fire Officer.

2020z CIRCULAR SILENCERS - CASING TO DW/144:

Provide circular silencers compatible with ductwork installation.

Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic, and non-combustible.

Construct casing to DW/144 with external flanges drilled for bolting to counterflanges on adjacent plant or ductwork, or with spigot ends where not connected to ductwork.

Retain infill by perforated galvanized mild steel sheet

Comply with IGE/UP/10 and BS 6644 for attenuators in flue dilution systems. Material of construction to be 304 stainless steel.

2030z CIRCULAR SILENCERS - NON-METAL:

Provide circular silencers compatible with ductwork installation.

Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic, and non-combustible.

Provide with external flanges drilled for bolting to counterflanges on adjacent plant or ductwork, or with spigot ends where not connected to ductwork.

2032z 'MELINEX' LININGS TO SPLITTERS AND SILENCERS:

Unless scheduled otherwise provide a “Melinex” lining in front of the infill in the following systems:

- Systems serving clinical areas in healthcare applications
- Systems serving clean rooms
- Systems where cleaning is required including kitchen extract
- Systems where the acoustic louvre will be handing moisture or chemically laden air

Where a 'Melinex' lining is to be included in front of the infill to prevent product migration or contamination of the infill it shall be greater than 23µm thick.

Full account of the reduction in performance of the silencer brought about by the addition of the lining shall be made when selecting silencers to meet the required performances.

2040z RECTANGULAR SILENCERS - CASING TO DW/144:

Provide rectangular silencers compatible with ductwork installation.
Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic, and non-combustible.
Construct splitters with low loss fairings where required to achieve pressure drop performance.
Construct casing to DW144 with external flanges drilled for bolting to counterflanges on adjacent plant or ductwork, or with spigot ends where not connected to ductwork.

Retain infill by perforated galvanized mild steel sheet
Comply with IGE/UP/10 and BS 6644 for attenuators in flue dilution systems. Material of construction to be 304 stainless steel.

2041z ACOUSTIC SPLITTERS:

Fix half width splitter to each side wall or as indicated.
Construct splitters to ensure that infill is retained and individual acoustic integrity is maintained.

Construct splitters with low loss fairings on entry and exit where necessary to meet pressure loss requirements.
Provide additional stiffening on horizontally mounted splitters.
Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic, and non-combustible.
Retain infill by perforated galvanized mild steel sheet unless otherwise indicated.

2050z RECTANGULAR SILENCERS - NON-METAL:

Provide rectangular silencers compatible with ductwork installation.
Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic, and non-combustible.

Provide external flanges drilled for bolting to counterflanges on adjacent plant or ductwork, or with spigot ends where not connected to ductwork.
Construct splitters with low loss fairings where required to achieve pressure drop performance.

2051z AIR TRANSFER/CROSS TALK ATTENUATORS:

Provide attenuators for air transfer and cross talk applications where indicated.
Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic, and non-combustible.
Construct splitters with low loss fairings where required to achieve pressure drop performance.
Construct casing to DW/144 or compatible with ductwork installation.

Provide external flanges drilled for bolting to counterflanges on adjacent plant or ductwork, or with spigot ends where not connected to ductwork.

2080z ACOUSTIC LININGS, PERFORMANCE TO BS EN ISO 354:

Line internal surfaces of ducts as described in DW/144.

Provide lining that is inert, fire proof, inorganic, vermin proof, non-hygroscopic and non-combustible.
Material - polyurethane foam, melinex lined.
Lining to achieve the following minimum random incidence absorption coefficients in accordance with BS EN ISO 354, or as indicated.

Frequency Hz	125	250	500	1k	2k	4k
	0.15	0.25	0.5	0.7	0.8	0.9

Protect lining against product migration and erosion.

2090z ACOUSTIC INSULATION:

Where indicated provide acoustic insulation.
Provide flexible system unless indicated otherwise. Supply with associated acoustic insulation as a factory made composite whenever possible.

Standard: Tested and rated in accordance with relevant parts of BS EN ISO 10140
Fire resistance: Class O Building Regulations when tested to BS476 -6 and BS 476-7.
Flexible system

Continuous quilted mineral (rock) fibre mat of density not less than 45kg/m^3 or foam at least 50mm thick with sandwich layer of polymeric material, minimum 1mm thick, with minimum mass of 10 kg/m^2 (unless scheduled otherwise elsewhere in the particular specification). Ensure surface finish complies with BS 476 - 7, Class 1 as a minimum. The polymeric mass layer should be positioned outermost from the sound source and overlapped at all joints. The product must be designed to maintain its original thickness subsequent to installation. The lagging should be cut 25mm oversize and a 25mm strip of the inner resilient element removed to create an overlap. The mass layer must not come in contact with the duct of pipe
Overlap and seal all joints with adhesive and external reinforcing tape.
Overlap and seal all joints with adhesive and suitable external reinforcing tape.

Particular attention should be paid to support the acoustic lagging at joint locations and where sagging may occur, eg in “soffit” areas.

For circular applications including soil-vent and rainwater pipes, ductwork etc, the lagging should be secured in place, either by using integral self-adhesive overlap or an alternative method approved by the SO. For vertical installations above 3m additional support should be provided in the form of aluminium bands at 200mm.

2120 ACOUSTIC LOUVRES: (Refer to Y46. 2252)

2140z ACOUSTIC ENCLOSURES:
Construct wall panels, frames and floor panels to meet the performance indicated, from materials suitable for location.
Ensure joints provide adequate seal to meet requirements.

Achieve minimum random incidence absorption coefficients in clause 2080z in accordance with BS EN ISO 354, unless otherwise indicated.
Provide inspection windows where indicated.
Supply cable access floor panels where indicated.

3000 WORKMANSHIP

3010 GENERAL:
Install acoustic treatment equipment in positions indicated, in accordance with manufacturer’s instructions.

3020 ACOUSTIC ENCLOSURES:
Ensure that erection is carried out by enclosure manufacturer.

3030 ACCESS TO ACOUSTIC ENCLOSURES:
Provide door type openings in enclosures as required for access to items enclosed.
Provide openings for inlet and discharge ductwork and for connections as indicated.
Provide angle flange connections for mating to ductwork and equipment.

3040 SUPPORTS:
Supply steel section supporting frames or brackets where silencers are fixed to the walls of air chambers.

3050 ACOUSTIC LININGS:
Where personnel access is provided, protect acoustic linings to prevent damage.

3060z SOUND PRESSURE LEVEL READINGS:
Measure sound pressure levels at the positions indicated using equipment in accordance with BS EN 61672-1 and BS EN 61672-2.

3070z SOUND INSULATION MEASUREMENTS:

Measure sound insulation of building elements in accordance with the relevant parts of BS EN ISO 16283 as appropriate.

10000 NES

Based on version NES Y45 text March 19

Y46 – Grilles/ Diffusers/ Louvres

1011 PERFORMANCE:

Air Supply

Unless detailed otherwise elsewhere in this specification, schedules or drawings, the maximum mean air velocity in the occupied zone shall comply with category B thermal environment in accordance with BS EN ISO 7730 (PPD<10%) table A5.

eg for offices and other mainly sedentary spaces : Cooling 0.19m/s; Heating 0.16m/s.

Blades - Supply grilles and diffusers with blade profile to ensure correct aerodynamic performance and minimal noise generation.

Louvres - Ensure air velocities through face area of louvres minimises "carry-over" of rain, snow or other precipitation into ducts, shafts or plant rooms and ensure louvres are tested in accordance with BS EN 13030 and are the subject of on-going factory production control auditing. Performance classes to BS EN 13030 are as scheduled in Y46sch1.

1020z SIZE / FIXINGS GENERALLY

All sizes indicated are 'nominal'. Provide site dimensions of all louvres, diffusers and grilles before manufacture. Ensure integration and co-ordination with ceiling details, other drawings and with ceiling grid site setting out as indicated on the architects drawings.

1030 NOISE LEVELS:

Ensure sound power levels or room NR / NC levels indicated are not exceeded. Ensure accessories for grilles and diffusers have low noise generation characteristics, and cause minimum disturbance to airflow.

1033 PROTECTIVE WRAPPING:

Apply protective wrapping to exposed architectural finishes prior to despatch to site.

1035 TESTING:

Manufacturer's catalogue / selection data to be based on laboratory testing / rating of air terminal devices in accordance with the following standards as appropriate to the particular types of devices to be installed:

BS EN 12238 - aerodynamic testing, mixed flow under isothermal conditions

BS EN 12239 - aerodynamic testing, low velocity for displacement applications under non-isothermal conditions

BS EN 16445 - aerodynamic testing, mixed flow under non-isothermal conditions

Provide air terminal devices tested in accordance with, BS EN ISO 5135 for determination of sound power levels

Comply with BS EN 13030 for performance testing of louvres subjected to simulated rain.

Where mock up testing is required, measure air velocity / flow rates, temperatures and sound pressure levels in accordance with BS EN 15726. Refer to schedule Y51sch1.

1041 ELECTRICAL BONDING TERMINAL:

Ensure an electrical bonding terminal suitable for connection of a bonding conductor with cross-sectional areas in the range 2.5mm^2 to 10mm^2 is provided on metal grilles, diffusers and louvres where indicated.

2000 PRODUCTS/MATERIALS

2009 MOUNTING:

Grilles

Flanged screw fixings - Used on the following grille types: fixed blade, adjustable blade, egg crate, non-vision

Concealed fixings - Used on the following grille types: mesh, linear

unless otherwise indicated

Diffusers

Flanged screw fixings - Used on the following diffuser types: punkah louvre

Hidden screw fixing - Used on the following diffuser types: circular, linear, straight line fixed louvre

Rear suspension brackets - Used on the following diffuser types: perforated face, adjustable curved blade, straight line fixed louvre, high induction, laminar flow panel

Internal concealed fixings - Used on the following diffuser types: linear lighting/air module, straight line fixed louvre

Hidden bayonet fixing - Used on the following diffuser types: extract/exhaust valve

unless otherwise indicated

Louvres
Side screw fixings.
or Rear angles or cleats.
or As otherwise indicated.

2010A GRILLES - FIXED BLADE TYPE:
Secure blades within flanged mounting frame or core collar.
Provide support mullions to ensure blade stability.
Style, blade rows and air pattern control as indicated on schedule or drawings.
Fix blades at an angle to the horizontal
Grilles to be complete with Allen key operated opposed blade damper unless scheduled otherwise.

2020A GRILLES - ADJUSTABLE BLADE TYPE:
Pivot blades within flanged mounting frame and retain blades in set position by tensioners external to the airstream.
Allow each blade in a row of blades to be individually adjustable.
Grilles to be complete with Allen key operated opposed blade damper unless scheduled otherwise.

2030A GRILLES - MESH TYPE:
Core material
Cellular, expanded or perforated as indicated on schedule or drawings.
Frame
Flange mounting frame or plate flange as indicated on schedule or drawings.
Fixing
Permanently fixed or designed for easy removal, as indicated.
Grilles to be complete with Allen key operated opposed blade damper unless scheduled otherwise.

2040z GRILLES - EGG-CRATE TYPE:
Core material - Aluminium or plastic or as otherwise indicated.
Style – With frame or as otherwise indicated.

2042 GRILLES - SECURITY TYPE:
Comply with requirements of the Ministry Of Justice Prison Service Specification and / or the Home Office Police Custody Design Guide.
Type - High security unless scheduled otherwise
Unless scheduled otherwise:
Material - 3mm thick mild steel plate.
Perforations - 3mm dia at a 5mm pitch.
Grilles to be complete with Allen key operated opposed blade damper.

2050 GRILLES - LINEAR TYPE:
Type and blade angle – as scheduled
Supply linear type grilles with one row of parallel blades. Secure blades within mounting frame or opening.
Grilles to be complete with Allen key operated opposed blade damper unless scheduled otherwise.

2060A GRILLES - FLOOR TYPE:
Supply linear type floor grilles with one row of parallel blades.
Permanently set at angle indicated. Incorporate bar reinforcement.
Loading - in accordance with BS EN 13264 as scheduled or detailed elsewhere in this specification.
Type and Core type / details as scheduled

2070A TRANSFER GRILLES - SIGHTPROOF NON-VISION TYPE:
Supply sightproof non-vision grilles with one set of blades.
Fix within a flanged mounting frame or a core box unless otherwise indicated.

2070B TRANSFER GRILLES - LIGHTPROOF NON-VISION TYPE:
Supply lightproof non-vision grilles with two sets of blades.
Fix within a flanged mounting frame or a core box unless otherwise indicated.

2070C TRANSFER GRILLES - FIRE RESISTANT NON-VISION TYPE

Supply grilles comprising Zintec steel frame with an intumescent core and two steel grilles, colour as indicated or scheduled.
Comply with the requirements of BS 9999.
Fire resistance tests for wall, ceiling or floor mounting types in accordance with BS EN 1364-5 or BS 476-22.
Fire resistance tests for door mounting types in accordance with BS 476-22.
Fix as indicated in accordance with the manufacturer's recommendations.

2070D TRANSFER GRILLES - FIRE RESISTANT NON-VISION TYPE WITH SMOKE CONTROL FACILITY:

Supply grille assembly comprising Zintec steel frame with an intumescent core with damper and actuator assembly to automatically close in the event of an alarm, power failure or damage to wiring. Units to be complete with steel cover grilles, colour as indicated or scheduled.
Comply with the requirements of BS 9999.
Fire resistance tests for door mounting types in accordance with BS 476-20 and BS 476-22.
Smoke leakage tests for smoke shutter type through door sets to be in accordance with BS 476-31.1.
Fix as indicated in accordance with the manufacturer's recommendations.

2070E TRANSFER GRILLES - ACOUSTIC TYPE TO REDUCE CROSS TALK:

Material - aluminium extrusion.
Unit to form a labyrinth airway lined internally with acoustic damping media. Cores to be enclosed within a flanged frame with sealing gasket.
Fix within door or partition in accordance with the manufacturer's recommendations.

2080A CONE TYPE CIRCULAR DIFFUSERS:

Supply circular diffusers manufactured to ensure rigid and smooth outer cone or frame, and inner assembly. Space all cones to ensure even distribution of air flow with minimum resistance and noise, and to allow easy cleaning.
Cone type

Fixed or adjustable deflection cone type as indicated. Inner assembly to move vertically by vertical sliding action or rotation.

2080B PLAIN FACE OR PAN TYPE CIRCULAR DIFFUSERS:

Supply circular diffusers manufactured with a smooth circular adjustable face plate to give a 360° air pattern and inner adjustable control disc assembly.

2090A DIFFUSERS - LINEAR SLOT TYPE:

Adjustable 1 way, 2 way or vertical projection continuous slot type
Supply single unit or continuous length linear diffusers manufactured with one or more rigid and smooth line slot units with parallel bars and partitions.
Fit closing caps at ends of single or multiple continuous length units.
Provide continuous lengths complete with locating pins or strips with keys to ensure correct alignment of abutted ends.
Air Controller - Fit each slot with device indicated.

2090B DIFFUSERS - HIGH INDUCTION BARREL SLOT TYPE:

Supply high induction linear slot diffusers. Provide polymer control air blades / barrels capable of providing alternating air flow direction every 150mm.
Air control blades to be factory set to scheduled requirement, but be adjustable for site commissioning.
Fit closing caps at ends of single or multiple continuous length units.
Provide continuous lengths complete with locating pins or strips with keys to ensure correct alignment of abutted ends.
Provide each diffuser with plenum box incorporating suspension points and circular side entry air supply spigots. Fit each plenum with air control damper device unless scheduled otherwise.

2100 DIFFUSERS - PERFORATED FACE TYPE:

Supply perforated face diffusers with rigid and smooth inlet spigot expanded to butt and seal against easily removable framed perforated front panel. Incorporate back deflectors above front panel, set to give required performance.

Supply type and profile of framed perforated front panel to mount flush with surrounding false ceiling panels.

2110A ADJUSTABLE CURVED VANE DIFFUSER:

Supply diffusers manufactured from curved cross sectional profile parallel blades pivoted at each end within flanged mounting frame. Ensure that each vane is individually adjustable to give directional control of airstream. Retain vanes in set position by tensioners external to airstream.

Control ways as indicated on drawings or schedules.

2130B FIXED LOUVRE LINEAR DIFFUSER WITH REMOVABLE CORE:

Supply diffusers manufactured from louvre type parallel blades permanently set and securely fixed within frame.

Supply core frames which are easily removable from flanged mounting frame.

Control ways as indicated on drawings or schedules.

2140A JET AIR NOZZLE DIFFUSERS:

Supply diffusers manufactured with adjustable core. Supply core in the form of a rotatable sphere with circular outlet nozzle, the whole retained by a flanged cup allowing manual or motorised change of discharge air pattern as scheduled to give a high velocity jet with adjustable discharge angle of -30° to +30°. Incorporate tapped ring for duct mounting, complete with felt, foam rubber or plastic sealing ring and fixing bolts or screws. When connecting to ends of flexible ducting, fit rigid flanged extension collar.

2140B DRUM JET TYPE DIFFUSERS:

Supply diffusers manufactured with adjustable core. Supply core in the form of a rotatable cylinder with a rectangular outlet nozzle, the whole retained by a flanged frame allowing manual change of discharge air pattern to give an adjustable high velocity jet, by adjustable integral vertical blades giving a discharge angle adjustable between -30° to +30°.

Incorporate tapped ring for duct mounting, complete with felt, foam rubber or plastic sealing ring and fixing bolts or screws. When connecting to ends of flexible ducting, fit rigid flanged extension collar.

Where scheduled incorporate manually adjustable horizontal front air pattern control blades for jet air dispersion and throw length control.

2140C JET TYPE NOZZLE WITH SWIRL UNIT:

Supply diffusers manufactured with adjustable core. Supply core in the form of a rotatable sphere with circular outlet nozzle with the whole retained by a flanged cup allowing manual or motorised change of discharge air pattern as scheduled to give a high velocity jet, with adjustable discharge angle of -30° to +30°.

Incorporate swirl unit air control blades and cap for two-step reduction of the throw distance.

2140D JET DIFFUSERS WITH REVERSIBLE / ROTATABLE CORE:

Supply diffusers manufactured with reversible and rotatable core (through 180°). Core to be reversible to provide either a straight core for "jet" setting or diffused core for "air diffusion pattern".

Diffuser spigot to be capable of 360° rotation within the mounting plate to enable jet direction adjustment.

2150 DIFFUSERS - LINEAR LIGHTING/AIR MODULAR TYPE:

Supply diffusers complete with connecting unit for installation behind module flanges, ensuring neat and unobtrusive appearance.

Fit plenum box with integral independent air volume regulating vanes to direct an equal air velocity along complete length of connecting air diffuser slot. Ensure easy access from below to regulating vanes. Retain vanes in set position by tensioners external to air stream.

Fit spigot, suitable for flexible ducting joint connection to plenum box.

Ensure that supports are independent, and do not depend upon module casing or flanges.

2160 LAMINAR FLOW PANELS:

Supply laminar flow panels suitable for use in clean rooms, laboratories and operating theatres. Panels to be complete with a low free area (typically 15%) perforated discharge plate at the face of the diffuser complete with rear plenum box and spigot entry. Fit baffle within the plenum box to distribute air evenly and achieve the laminar air pattern.

2170B HIGH INDUCTION SWIRL DIFFUSERS:

Supply high induction diffusers with either fixed blades or variable geometry comprising either manually adjustable air control blades or actuated blades using wax filled cylinder or electric motor as scheduled. Units to use rotary motion in discharge air pattern to accelerate mixing.

2172A CIRCULAR SWIRL FLOOR MOUNTED DISPLACEMENT DIFFUSERS:

Unless scheduled otherwise, supply die cast aluminium diffusers suitable for fitting into a pressurised floor void with standard floor tile thicknesses up to 50mm. Swirl element to be made of polymer and adjustable for horizontal or vertical air discharge.

Unless scheduled otherwise each diffuser to be complete with dirt trap.

2174A WALL OR FREE STANDING LOW VELOCITY DISPLACEMENT DIFFUSERS:

Unless scheduled otherwise, units to be complete with galvanised steel perforated front panel, minimum thickness 1.25mm and galvanised steel casing. Provide an air distribution plate or proprietary air scoops with nozzles located behind the front panel.

Finish to be powder coated or polyester-epoxy painted.

For recessed units recess the front panel into a rigid frame and fix with screws unless scheduled otherwise.

2174B FLOOR MOUNTED LOW VELOCITY DISPLACEMENT DIFFUSERS:

Supply recessed floor diffusers for installation in a pressurised floor or connected to ductwork via a plenum box as scheduled.

Loading - in accordance with BS EN 13264 as scheduled or detailed elsewhere in this specification.

Diffuser to be a tile replacement unit for raised floor system complete with an air distribution plate with nozzles fitted behind a perforated sheet steel front panel (minimum thickness 3mm), welded onto a framework.

2180DIFFUSERS - SUPPLY/EXHAUST VALVE TYPE:

Supply diffusers incorporating intake ring and adjustable valve disc assembly.

Provide bayonet type fixing for purpose made mounting ring with plastic foam sealing gasket.

Provide setting template.

Spinning disc to be powder coated steel.

Adjust valve to required setting and lock valve in required position.

2185 FABRIC AIR DUCT DISTRIBUTION DEVICES:

Supply fabric air distribution devices complete with all necessary stiffening devices, facilities for jointing sections, support system, suspension rails and fixings.

Manufacturer to provide full performance data for devices selected including air flow rate, pressure loss, throw etc.

The facilities shall be designed to prevent condensation and dust build up.

Shrinkage to be limited to 1% when washed in accordance with the manufacturers recommendations unless scheduled otherwise.

Materials to be classified for reaction to fire in accordance with BS EN 13501-1. Classes acceptable are A1, A2 or B having smoke emission classification of s1 and production of flaming droplets/particles classification of d0.

Test methods (reaction of fire)

BS EN ISO 1182 (non-combustibility test), BS EN ISO 1716 (determination of the gross heat of combustion), BS EN ISO 11925-2 (ignitability of product) and BS EN 13823 (product exposed to thermal attack by a single burning item) as appropriate.

2190A LOUVRES - EXTERNAL AIR SUPPLY/EXTRACT TYPE:

Provide louvres which have been tested in accordance with BS EN 13030, and which are the subject of ongoing factory production control auditing.

Performance and classification to BS EN 13030

Ensure louvres perform to water penetration class at a face / core velocity as scheduled.

Ensure louvres achieve a coefficient of discharge class as scheduled.

Construction

Construct louvre frame and aerodynamically profiled louvre blades from galvanized mild steel or aluminium.

Provide integral drainage channels.

Retain infill on louvre blades by perforated sheet of galvanized mild steel or aluminium.

Screen

Fit a bird-screen using mesh no coarser than 12mm, across inside face of louvres.

Fit an insect-screen using mesh no coarser than 3mm, across inside face of louvres only where scheduled.

Quality assurance

Ensure manufacturers are a firm of Assessed Capability to BS EN ISO 9001 and produce louvre to relevant Quality Assessment schedule.

Installation

Install louvres strictly in accordance with the manufacturer's instructions.

2200 LOUVRES/SCREEN WALLING:

Provide louvres which have been tested in accordance with BS EN 13030, and which are the subject of ongoing factory production control auditing.

Performance and classification to BS EN 13030

Ensure louvres perform to water penetration class at a face / core velocity as scheduled.

Ensure louvres achieve a coefficient of discharge class as scheduled.

Construct with mullions into which blades are fitted and provide blades with aerodynamic profiles and integral drainage channels. Mount assembly within frame. Ensure louvre system is integrated with weather louvres and incorporates doors with concealed hinges and frames. Where necessary provide mitred corners and slope louvres.

Ensure adequate space for access and maintenance of louvres and associated equipment is provided.

Screen

Fit a bird-screen using mesh no coarser than 12mm, across inside face of louvres.

Fit an insect-screen using mesh no coarser than 3mm, across inside face of louvers as indicated

Ensure manufacturers are a firm of Assessed Capability to BS EN ISO 9001 and produce louvre to relevant Quality Assessment schedule.

Install louvres strictly in accordance with the manufacturer's instructions.

2210A GALVANISED STEEL:

Galvanize steel in accordance with BS EN 10346, or BS EN 10143 and

2210B ALUMINIUM:

Use aluminium sheet/extruded aluminium produced to relevant parts of BS EN 485, BS EN 515, and BS EN 573 or relevant parts of BS EN 755

2220A GRILLE AND DIFFUSER CONSTRUCTION:

Ensure grilles and diffusers are robust and mounting frame flanges on square and rectangular terminals have mitred corners. Fit a rubber or plastic foam sealing strip or gasket to rear face of flange.

Diffusers

Ensure face of diffuser outer cone or frame is completely smooth.

Finish

Powder coat finish to an RAL colour specified as indicated or specified by the Architect.

2230A LOUVRE CONSTRUCTION:

Ensure louvres are robust. Incorporate in purpose made sub-frame. Provide drip sills.

2252 ACOUSTIC LOUVRES: (NES Y45 2120B)

Performance

Provide acoustic louvres as indicated, to meet performance indicated when producing a static pressure loss within that scheduled for the specified air flow.

Provide certified acoustic performance data measured in accordance with relevant parts of BS EN ISO 10140.

Ensure louvre withstands specified wind loads and prevents ingress of rain.

Construction

Construct louvre frame and aerodynamically profiled louvre blades from galvanized mild steel.

or aluminium.
or as otherwise indicated.
Provide integral drainage channels.
Provide acoustic infill which is inert, fire proof, inorganic, vermin proof and non-hydroscopic.
Acoustic infill to be wrapped with woven glass scrim cloth or 'Melinex' to prevent migration of particles into the airflow / protect the infill. Full account of the reduction in performance of the acoustic louvre brought about by the addition of the infill protection shall be made when selecting silencers to meet the required performances.

"Melinex" polyester film to be provided in front of the infill in the following applications unless scheduled otherwise:
Systems serving clinical areas in healthcare applications
Systems serving clean rooms
Systems where cleaning is required including kitchen extract
Systems where the acoustic louvre will be handing moisture or chemically laden air

Retain infill on louvre blades by perforated sheet of
galvanized mild steel.
or aluminium.
or as otherwise indicated.

Arrangement
In breakdown form for site assembly.
or In modular panel form.
or For assembly on site to form an enclosure complete with roof and door.
or As otherwise indicated.

Screen
Fit a bird-screen using mesh no coarser than 12mm, across inside face of louvres.
Fit an insect-screen using mesh no coarser than 3mm, across inside face of louvers as indicated.

Quality assurance
Ensure manufacturers are a firm of Assessed Capability to BS EN ISO 9001 and produce louvre to relevant Quality Assessment schedule.

3000 ACCESSORIES

3010A OPPOSED BLADE VOLUME CONTROL DAMPERS :
Balance and tension operating mechanisms to give positive setting for blade positions from fully open to fully closed.
Local blade operation
Supply device for operating the damper blades through face or side of grille/diffuser as indicated.
Remote blade operation
Supply and install proprietary remote control unit with all necessary brackets and linkage at the control unit. Provide label at the control unit to indicate function.

3040A BUTTERFLY VOLUME CONTROL DAMPERS:
Operate via a simple hooked wire key connecting with a lug on the underside of each plate; or by a loose key locating into a control mechanism.

3051 `IRIS' TYPE VOLUME CONTROL DAMPERS:
When in fully open setting ensure that unit inside diameter is equal to full internal diameter of air diffuser spigot, or ducting branch connection.
Operation
By loose key, unless otherwise indicated.

3060A FIXED AIR FLOW DEFLECTORS:
Direct airstream evenly from main ducting into branches or spigots serving air grilles and diffusers by using a number of equally spaced curved blades linked together.

3060B ADJUSTABLE AIR FLOW DEFLECTORS:
Direct airstream evenly from main ducting into branches or spigots serving air grilles and diffusers by using a number of equally spaced curved blades linked together.

3070 BLANKING PLATES:
Supply blanking plates to restrict projection of air flow from a particular section of grille or diffuser. Ensure that indicated dimensions or angles in degrees are maintained.

3080 PERFORATED BAFFLE PLATES:
Cover full width or depth of plenum box and extend beyond each side of air inlet to ensure even air distribution. Position centrally relative to plenum box air inlet.

3090 PERFORATED SCREENS:
Fit perforated screens behind grille volume control devices to equalize air flow and pressure. Contain perforated sheet within rigid surrounding frame, incorporating fixing brackets or lugs.

3100 CEILING OR WALL MOUNTED PLENUM BOXES:
Supply single plenum box or series of plenum boxes butted together to form continuous length, as indicated. Ensure sturdy and rigid construction with circular inlet spigots 65mm minimum length.
Incorporate at least four drilled angle brackets, or flat bar lugs, for securing to, or suspension by rods or wires from building or other construction.

3110 FLOOR MOUNTED PLENUM BOXES:
Supply single plenum box or series of plenum boxes butted together to form continuous length, as indicated. Ensure sturdy and rigid construction with circular inlet spigots 65 mm minimum length. Ensure box base material and reinforcement is able to withstand pressures of concrete handling and pouring when casting into floor slab.
Incorporate at least four drilled angle brackets, for fixing to slab soffit, or building ragged ties when casting into a floor slab.

3120A HINGED LOUVRE ACCESS PANELS AND DOORS:
Incorporate purpose made access panels or doors within body of louvres, manufactured from compatible materials.
Use hinged access panels or doors of single or double style and with front or rear locking facilities.

3130z SPARES:
Supply 5 loose keys, suitable for adjusting each size and type of grille, or operating accessories.

4000 WORKMANSHIP

4010 GRILLE/DIFFUSER LOCATION:

Fit at terminal air supply, extract and transfer points indicated, in accordance with the manufacturers' recommendations and HEVAC Guide to Air Distribution Technology for the Internal Environment.

4020 LOUVRE LOCATION:
Fit at system main air intake and discharge points, as indicated.

4030 ACCESSORIES:
Supply all grilles, diffusers etc with OBDs unless indicated otherwise. Fit other accessories to each grille and diffuser in accordance with manufacturer's instructions and as indicated.

4040 CONNECTION TO DUCTWORK:
When connecting directly to duct spigot, secure grille mounting frame or flange with screws, or bolts and nuts, to returned flange, with filled in corners, at end of duct spigot.

4050z INSTALLATION IN BUILDERSWORK:

Ensure outer edge of grille mounting frame or flange extends on all sides beyond the joint between any builders work frame and surrounding building construction.
Ensure grilles are sealed to building fabric - including ceilings, to prevent air leakage from pressurized rooms to voids above.
Fix louvres to building fabric in accordance with the manufacturers' recommendations using face flange.
or Building in lugs.
or Rear studs.
or Masonry frame - supply only for fixing by others.
or As otherwise indicated.

4060A TRANSFER GRILLES:
Where transfer points are located in partitions or walls, prevent through vision by fitting a fixed blade grille on both faces of partition or wall. Connect cavity wall or partition transfer grille assemblies with ducting sleeve or collar extending between grilles.

4060B TRANSFER GRILLES WITH FIRE DAMPER OR WITH FIRE DAMPER + SMOKE CONTROL DAMPER
Where transfer points are located in partitions or walls, prevent through vision by fitting a fixed blade grille on both faces of partition or wall. Connect cavity wall or partition transfer grille assemblies with ducting sleeve or collar extending between grilles.
Incorporate fire damper in fire compartment wall transfer grille assembly.
Comply with the manufacturer's installation instructions and any control / wiring requirements in W60 and/or W50 and schedules / scope of works.

4070 INSTALLATION OF FABRIC AIR DUCT DISTRIBUTION DEVICES:
Ducts to be delivered to site in sealed polyethylene bags and stored on site in a dry, dust free environment in accordance with the manufacturer's recommendations.
Do not crush or bend devices.
Install devices and join sections in accordance with the manufacturer's recommendations.
Commission system in accordance with the manufacturer's recommendations.

4075 FIXING:
Provide details of fixing method for all grilles, diffusers, louvres and other terminal devices for approval.

10000 BASED ON NES Y46 Dec 19

Y50 – Thermal Insulation

1000 GENERAL

1010 TEMPERATURE RANGE:

Refer to insulation manufacturer's recommendations to determine suitability of different insulation materials at different temperature ranges.

1021 STANDARDS:

All thermal insulation and methods of application shall comply with the requirements of the current version of British Standards, Codes of Practice Building Regulations including but not limited to:-
Relevant parts of BS 476, , BS EN 13166, BS 3958, BS 5422, BS 9999, BS 5608, BS 5970, BS 7572, relevant parts of BS EN 13941and BS EN ISO 12241 as appropriate to the project particular requirements.
For product clauses comply with BS EN 14303, BS EN 14304 and BS EN 14314
Latest edition of Building Regulations Part L Approved Documents and the following 2nd tier documents:

Non domestic and domestic building services compliance guides.
TIMSA HVAC compliance guide.

Description of terms as BS 3533.
Use insulating materials that comply with EU Regulation 517/2014 fluorinated greenhouse gases.
Use insulating materials that comply with EC Regulation 1005/2009 on substances that deplete the ozone layer.
All insulation products must have a Declaration of Performance (DoP) certificate and be CE marked in accordance with the Construction Products Regulations 2013 (CPR).
Comply with BS EN 16783 and BS EN 15804 in preparing environmental product declarations (EPD's)

1031 MATERIALS:

All insulation materials, adhesives and finishes in compliance with BS 476-4 , non-combustion test; or obtain a Class 'O' fire rating to Building Regulations to BS 476-6 and 7 and shall not be flammable or support combustion.
Materials classified according to BS EN 13501-1 (ref clause Y50.1036) shall not show propensity for continuous smouldering combustion when tested in accordance with BS EN 16733
Ensure metals and materials that cause galvanic corrosion are not installed in contact. Do not use galvanised or zinc coated steel jacketing and accessories on austenitic stainless steel or nickel steel/alloy equipment and piping.
Comply with the CLP regulation 2015 (European Regulation EC 1272/2008)

All insulation materials shall be:-

- Inherently proof against rotting, mould and fungal growth and attack by vermin.
- Non-hygroscopic and in all respects be suitable for continuous use throughout the range of operating temperatures and within the environment indicated.
- Wholly compatible with the material it is insulating at the design working temperature and environmental conditions.
- Free from chemicals which may contribute to corrosion or degradation of the insulated surface or finish.
- Comply with the Health & Safety at Work Act and COSHH Regulations and be non carcinogenic.
- Asbestos Free. (Where any work is carried out on existing thermal insulation material or finish which contains asbestos in any form, attention is drawn to responsibilities under the provisions of the Control of Asbestos Regulations 2012).
- First class quality new materials delivered to site fully dried out and housed in dry store until ready for use.

For all mineral wool insulation products, test evidence must be available showing that the fibres from which the products are made are not classified as a possible human carcinogen.

Use insulating materials with a Global Warming Potential (GWP) of less than 5.
Use insulating materials with an Ozone Depletion Potential (ODP) of zero.

1036 EUROPEAN CLASSIFICATION FOR REACTION TO FIRE PERFORMANCE:

Supply insulating materials classified in accordance with BS EN 13501-1 Fire classification of construction materials. Classes acceptable are A1 / A1L, A2 / A2L or B / BL having smoke emission classification of s1 (materials that give off little or no smoke) and production of flaming droplets/particles classification of d0.

Test methods

BS EN ISO 1182, BS EN ISO 1716, BS EN ISO 11925-2 BS EN 13823 as appropriate.

1045 CONTROL OF FIBRE MIGRATION:

Ensure all mineral wool type materials are fully wrapped with foil cover and sealed with tape to stop fibre migration.

1051 SPREAD OF FLAME:

When completed, ensure surface-finish complies with BS 476-7 Class 1 spread of flame, unless otherwise indicated.

1052 PRE-INSULATED PIPELINES AND AIR DUCTLINES:

In locations where insulation cannot be installed after erection of pipelines or air ductlines pre-insulated sections shall be installed. Insulation to such sections shall be equivalent in thermal and physical properties to that specified for the remainder of the system. Where vapour barriers are provided their integrity shall be maintained over the pre-insulated sections and the junctions to the remainder of the system.

1055 SMOKE EMISSION CHARACTERISTICS:

Ensure only products classified by BS EN 13501-1 as s1 (materials that give off little or no smoke) are used.

1060 PRE-INSULATED EQUIPMENT:

Where fire and surface spread of flame certificates relate to factory made products, ensure that certificates are still valid where products are incorporated in pre-insulated equipment.

1070 PROTECTION APPLIED IN SITU:

Where fire and surface spread of flame certificates relate to factory made products, ensure that the certificate remains valid when the finish is site applied.

1081 ELECTRICAL BONDING:

Ensure an electrical bonding connection of 6-mm^2 conductor is provided where required to maintain electrical continuity.

1091 INSPECTION AND TESTING:

Where indicated arrange performance test of thermal conductivity on materials selected, carried out at manufacturer's works or at an approved laboratory and in accordance with appropriate British Standard.

Provide assistance to allow for inspection of all sizes of insulation on all services after installation to determine thickness and compliance with specification. Make good any sections that are cut during inspection for thickness and compliance with specification.

2000 PRODUCTS/MATERIALS

2010 THERMAL CONDUCTIVITY:

All thermal conductivity figures given in insulation product clauses are typical values at the mean temperature stated, as declared in manufacturers Declaration of Performance (DoP) certificates in accordance with the CPR.

2016 THERMAL PERFORMANCE LIFE EXPECTANCY

Ensure the insulation will maintain its thermal performance for a minimum of the plant design life and provide manufacturers details which define the life expectancy of the insulation material. The Lambda value of the insulation should also be quoted at both manufactured and aged value in accordance with BS EN 14314 for phenolic foam products.

2021 RESTRICTIONS ON USE OF MATERIAL:

Protect insulated stainless steel surfaces from the risk of stress corrosion in accordance with the recommendations in BS 5970.
Do not install insulants with man-made mineral fibres in food preparation areas or aseptic areas.
For all mineral wool insulation products, test evidence must be available showing that the fibres from which the products are made are not classified as a possible human carcinogen, as detailed by European Directive 97/69/EC and the Approved Supply List of CHIP98 and that the fibres should be bio-soluble.

2030 ROCK or GLASS MINERAL WOOL PIPE INSULATION:

Standard - BS EN 14303
Nominal density 120 kg/m^3
Thickness 20mm to 100mm
Thermal conductivity
Rock Wool - Typical value of 0.033-0.034W/mK at a mean temperature of 10°C
Glass Wool – Typical value of 0.033 W/mK at a mean temperature of 10°C
Finish -Reinforced aluminium foil with at least 25mm overlap.

2040 MINERAL WOOL RIGID DUCT INSULATION:

Standard - BS EN 14303.
Type – Rock or glass
Nominal density - 45 - 48 kg/$m^{3.}$
Thickness - 25mm to 100mm.
Thermal conductivity - - Typical value of 0.033 - 0.034W/mK at a mean temperature of 10°C
Finish- Reinforced aluminium foil

2050 MINERAL WOOL FLEXIBLE DUCT INSTALLATION:

Standard - BS EN 14303.
Type – Rock or glass
Nominal density 28- 45 kg/m^3
Thickness - 25mm to 60mm
Thermal conductivity - Not exceeding 0.033 - 0.034 W/mK at a mean temperature of 10°C
Finish -Reinforced aluminium foil

2060 ROCK OR GLASS MINERAL WOOL LAMELLA OR CRIMPED MAT DUCT INSULATION:

Standard - BS EN 14303.
LAMELLA
Nominal density –24 - 45 kg/m3.
Thickness - 25mm to 80mm.
Thermal conductivity
Typical value of 0.04 W/mK at a mean temperature of 10°C
Finish - Reinforced aluminium foil.
The Lamella duct insulation must be factory produced, by the mineral Wool manufacturer, ‘on line’ in one continuous process and not converted as a separate production process.

CRIMPED MAT
Nominal density – 25 to 45 kg/m3
Compression resistance - Maximum of 13% compression at a static load of 2 kPA,.
Thickness - 25mm to 80mm.
Thermal conductivity

Typical value of 0.039 W/mK at a mean temperature of 50°C
Finish - Reinforced aluminium foil.

2111 CLOSED CELL RIGID PHENOLIC FOAM (PF) PREFORMED SECTIONS - CFC AND HCFC FREE:
Standard - BS EN 14314 Nominal density - 35 - 40 kg/m^3.
Temperature range - -180° to +120°C.
Thickness - 15mm to 50mm.

Thermal conductivity
Typical value of 0.025 W/mK at a mean temperature of 10°Cwhen fully aged in accordance with BS EN 14314.
Finish
Reinforced aluminium foil or manufacturer's standard matt black as scheduled.
All phenolic foam sections shall have been completely treated, at the insulation manufacturer's works, with a suitable dust suppressant, acid neutralising and passivating coating. Also, all exposed edges of phenolic foam insulation shall be sealed to the surface being insulated with a suitable vapour sealing mastic

2121 CLOSED CELL RIGID LAMINATED PHENOLIC FOAM (PF), DUCT INSULATION SLAB - CFC AND HCFC FREE:
Standard - BS EN 14314 Nominal density - 40 kg/m^3.
Thickness - 20mm - 50mm
Thermal conductivity
Typical value of 0.022 W/mK at a mean temperature of 10°C when fully aged in accordance with BS EN 14314.

2131 HIGH DENSITY PHENOLIC PIPE AND DUCT SUPPORT FOAM - CFC AND HCFC FREE
Standard - BS EN 14314
Nominal density - 80 kg/m^3 to 120 kg/m^3.
Temperature range - 180°C to +120°C.
Thermal conductivity
Typical value of 0.045 W/mK at a mean temperature of 50°C. when fully aged in accordance with BS EN 14314.

2140 CLOSED CELL NITRILE AND EPDM RUBBER ELASTOMERIC SHEET AND PREFORMED FLEXIBLE SECTIONS CFC/HCFC FREE AND ZERO ODP/GWP:
Standard BS EN 14304
Nitrile rubber
Nominal density - 45 - 100 kg/m3.
Temperature range - 50°C to +110°C
Thickness
Sections
6mm to 32mm for pipe sizes 6mm to 114mm.
Sheets - 6mm to 50mm.
Thermal conductivity
Typical value of 0.036 W/mK at a mean temperature of 20°C.
EPDM rubber
Nominal density - 45 - 100 kg/m3.
Temperature range - -50 to +150oC
Thickness
Sections - 10mm to 25mm for pipe sizes 10mm to 89mm.
Sheets - 10mm to 32mm.
Thermal conductivity - Typical value of 0.045 W/mK at a mean temperature of 40°C.

2170 VAPOUR BARRIER PERMEANCE:
Comply with requirements of BS 5422 and BS 5970.
Maximum permitted water vapour permeance in relation to plant temperature at an ambient temperature of +20°C (dry bulb) to be in accordance with BS 5422, Table 1.

2185 ACOUSTIC INSULATION:

Where indicated provide acoustic insulation.
Refer to Y45 clause 2090z for technical details and schedule Y45sch for locations / systems.

2190 ADHESIVES

Comply with the recommendations of clause 10.1 of BS 5970 for insulation bonding adhesives; lagging adhesives; and facing and film attachment adhesives.

2195 FIRE PROTECTION CLADDING

Where indicated, ductwork shall be provided with a proprietary fire protection cladding material as described below.

The fire protection material and all ancillary fixing products shall be shown as a system (by independent test) to meet the requirements of BS EN 1366-1 in the case of supply and extract ventilation systems and classified in accordance with BS EN 13501-3.
In the case of smoke extract / fire ventilation the system shall meet the requirements of BS EN 1366-1 and BS EN 1366-8 or BS EN 1366-9 and classified in accordance with BS EN 13501-4.
For kitchen extract ducting systems it shall be shown by test or assessment by an independent 3rd party to meet the requirements BS 476-24 or BS EN 1366-1 and classified in accordance with BS EN 13501-3.
In each case the criteria as defined in the above test standards of stability, integrity and insulation shall each be achieved fully for the required period of protection as scheduled or described in the particular specification.

Generally all ducts shall be protected on all four sides. Where an adjacent slab or wall is conveniently placed to form one side of the enclosure this may be utilised subject to its fire rating being as that of the required enclosure being adequately connected and sealed to the wall or slab, and subject to agreement by the Engineer.

The following proprietary constructions are acceptable and represent the minimum required. All material thicknesses, adhesives and final installation and the underlying ductwork shall in all ways comply with the requirements of the Manufacturers material and installation instructions, Building Regulations and the Buildings Control officer to suit the scheduled period of fire protection and whether ducts are exposed internal or external fire or both.

Promat "Vicuclad" 430 kg/m^3 Board Cladding – (where ducts are required to be protected, the ducts shall initially be encased with mineral rock Wool slabs having a minimum density of 60kg/m^3 or 80kg/m^3)
Rockwool “Fire Duct” 160 kg/m^3 Ductwork slab rigid Insulation Fire Protection Board Cladding Saint - Gobain Isover “Ultimate-Protect” 66 kg/m^3 slab and flexible wired mat.

2201 POLYISOBUTYLENE PROTECTION:

Polyisobutylene - minimum thickness 0.8mm.

2202 PVC PROTECTION:

Rigid PVC - thickness 0.35mm.

2203 ALUMINIUM SHEETING PROTECTION:

Apply flat (embossed)or profiled aluminium cladding directly to insulating material, thickness, 0.56mm on pipework, 0.71mm on ductwork

2204 ALUMINIUM-ZINC COATED STEEL PROTECTION:

Mild steel sheet continuously hot dipped with 185gm aluminium-zinc coating to BS EN 10326 and BS EN 10327 applied directly to insulating material.
0.4mm thick flat sheet. Installation shall be in accordance with the manufacturers recommendations.

2205 SELF ADHESIVE WEATHER RESISTANT ZERO PERM MULTI-LAYER LAMINATE FOIL/FILM PROTECTION:

Enclose insulation with laminated foil/film around insulation and finish ensuring 75mm overlap for a complete vapour barrier.

Film to be either factory pre-applied or applied in-situ and be capable of providing vapour barrier. Product to be tested in accordance with BS 476 parts 6 & 7 and BS EN ISO 1716. Finish to be class O. Products to be highly puncture and tear resistant and have supporting test data in accordance with ASTM D-1000 & ASTM D-624. Product to be supported by a 10 year guarantee.

Normal use - 5 ply laminate comprising 3 layers of aluminium and 2 layers of polyester film coated with pressure sensitive adhesive.

Minimum application temperature -20^{0}C

Heavy duty use (eg pipework / ductwork which could be walked on regularly or low level pipework in plant areas) - 13 ply laminate. Minimum application temperature -20^{0}C

Seams on bends, elbows, tees etc and underlying foil faced insulation are to be sealed with the foil/film manufacturers recommended tape. Installation to be in accordance with the manufacturer's recommendations.

2211 REINFORCEMENT:

Use one of the following methods where reinforcement is required.

Galvanized wire netting - comply with BS EN 10223, not less than 0.9mm diameter wire, 25mm mesh (50mm mesh on ductwork).

or Galvanized wire -not less than 0.9mm diameter wire, spirally wound at 75mm pitch.

or Aluminium bands - not less than 20mm wide x 0.5mm thick with galvanized wire end loops, at 300mm centres.

2221 VALVES, ANCILLARIES AND FLANGE INSULATION:

Install insulation on all flanges and valves and other pipeline ancillaries. The only exception is on valves and pipeline ancillaries on hot services smaller than 32mm on internal applications where the heat loss can be demonstrated as "always useful". (Where un-insulated valves or ancillaries could cause a safety hazard, they shall be insulated)

Use a protected metal split casing fabricated from 1.2mm aluminium sheet fitted with spring clip fasteners, filled with insulating material with same thermal performance as insulation on adjoining pipe.

or Use moulded insulation boxes filled with insulating material with same thermal performance as insulation on adjoining pipe.

or Use proprietary flexible insulation jackets manufactured from aluminised glass cloth, with a minimum of 50mm mineral Wool infill fastened with Velcro and draw cord fastening.

Valve boxes shall include removable covers over handwheels and stems, comply as appropriate with BS 5970. Additionally, on cold applications, wrap cold piping valve bodies and flanges with 50mm thick flexible material with facing and seal joints to maintain vapour barrier.

2225 DUCTWORK FLANGE INSTALLATION

Insulation thickness should be selected such that a minimum thickness is carried over flanges and/or stiffeners for continuation of vapour barrier and/or sufficient insulation to avoid condensation.

2231 PROTECTION FOR HEAT EXCHANGERS AND OTHER VESSELS WITH CHEST COVERS:

Insulation to be mineral wool lamella or crimped flexible mat.

Finish with ribbed or embossed aluminium sheeting 0.9mm thick or 0.7mm aluminium-zinc coated steel embossed or ribbed sheeting with lapped, rivetted and sealed joints, laps to shed water. Seal all joints at manholes and stools. Fit cut outs with purpose made over-plates or collars. Domed tops of calorifiers to be finished in segments.

Enclose chests and access covers in removable aluminium covers lined with high density flexible material. Remove manufacturer's name plate and refix on cladding.

2241 INSULATION FOR BOILER FLUES, MINERAL WOOL, ALUMINIUM BANDS:

Where twin wall pre-insulted flues are not specified and a single wall carbon steel flues is installed, flues and chimneys to be insulated in accordance with BS 5970 using mineral Wool industrial wired mat with a minimum density 90 kg/m^3
Use preformed sections secured by metal bands direct to flue. Use multi-layers and stagger joints for thicknesses in excess of 65mm.
Material

Bonded mineral Wool with ribbed or embossed aluminium sheeting 0.9mm thick secured with aluminium bands.

2250 PRE-INSULATED BOILER FLUES:
Provide pre-insulated boiler flues where indicated / scheduled.

2260 PRE-INSULATED STORAGE VESSELS:
Ensure insulation standards on pre-insulated storage vessels meet the general specification requirements of the works.

2270 CYLINDER JACKETS:
Provide cylinder jackets as indicated.

2281 PUMPS AND OTHER IRREGULAR SHAPES:
All pumps, heat exchangers and other irregular shapes shall be insulated to prevent condensation.
All heat exchangers and other pipeline ancillary components shall be insulated to control heat loss.
Where access is required to pumps and other irregular shapes submit proposals for materials and methods of applying a demountable finish, for approval.
Comply with requirements of BS 5970.

2285 THICKNESS OF INSULATION:
Supply thickness of insulation as indicated. For HWS pipework trace heated for temperature maintenance refer to clauses 2291 and 2301 and schedule Y24.
Where a material with an alternative thermal conductivity (k factor) is offered, utilise a thickness which will provide an equivalent degree of insulation to the combination of thickness and k factor specified. The figures are derived from the tables given in BS 5422 and the calculation methods given in BS EN ISO 12441.

2286 CALCULATION OF INSULATION THICKNESS - BUILDING REGULATIONS:
Provide insulation of thickness conforming with the requirements of the Building Regulations (England and Wales) Part L Approved Documents or the Scottish Technical Handbooks, and the calculation methods given in BS EN ISO 12241 using the standardised assumptions within table C1 of BS 5422.

2287 CALCULATION OF INSULATION THICKNESS - ECA ENHANCED:
The insulation manufacturer selected for a particular project should calculate the minimum required thicknesses of pipework insulation based on the actual conductivity of the product at the relevant temperature and the criteria on the ECA web site for an eligible installation using the methodology set out in BS EN ISO 12241 and the assumptions set out in Table C1 of BS 5422.

2289 INSULATION THICKNESS TABLES AND PIPE SIZES:
Unless stated otherwise the thicknesses given in the tables in this specification are the nearest commercially available material thickness to meet the minimum calculated thickness to BS ISO 12241 and the product declared performance data for CE marking. Thicknesses have been calculated by manufacturers for each product and use thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures listed in the relevant tables.
Should alternative products be offered that may have different performance data the Contractor shall ensure the manufacturer undertakes calculations and submits appropriate thickness table.
For HWS pipework trace heated for temperature maintenance refer to clauses 2291 and 2301 and schedule Y24.

Unless specified otherwise elsewhere, the thicknesses for pipe of greater diameter, flat surfaces or irregular shaped plant items shall not be less than that for the largest pipe size given in the thickness tables

Most tables give steel pipe sizes as OD, equivalent nominal bore sizes are given below

Approx. OD (mm)	Nominal bore	Approx. OD (mm)	Nominal bore
17	10	140	125
21	15	165	150
27	20	219	200
34	25	273	250
42	32	324	300
48	40	356	350
60	50	406	400
76	65	457	450
89	80	508	500
114	100	610	600

2291 NON DOMESTIC HOT WATER SUPPLY SERVICES THICKNESS TABLE BUILDING REGULATIONS: ROCK & GLASS MINERAL WOOL:

Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and Section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of rock mineral wool (mm)		Thickness of glass mineral wool (mm)	
Surface emissivity	0.05	0.9	0.05	0.9
17	25	30	25	30
21	25	30	25	30
27	30	35	30	40
34	30	35	30	40
42	30	35	30	40
48	35	40	40	40
60	40	40	40	40
76	35	45	40	40
89	35	45	40	40
114	40	45	40	50
140	40	45	40	50
168	40	50	40	50
219	40	50	40	50
273 and above	45	50	40	50

Basis: Horizontal pipe at 60°C in still air at 15°C, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.

Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.

For trace heated HWS pipework for temperature maintenance, the thicknesses shall be adjusted (as advised by the trace heating specialist) to ensure the correct combination of thermal insulation (thermal conductivity / thickness) and heating cable (ie output / straight or double or spiral) to meet the design parameters in schedule Y24.

2305 NON DOMESTIC HOT WATER SUPPLY SERVICES BUILDING REGULATIONS PHENOLIC FOAM

Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of phenolic foam (mm)

Surface emissivity	(0.05)	(0.9)
17	15	15
21	15	20
27	15	20
34	20	20
42	20	20
48	20	25
60	20	25
76	25	25
89	25	25
114	25	30
140	25	30
168	25	30
219	30	30
273 and above	30	30

Basis: Horizontal pipe at 60°C in still air at 15°C, aged k value. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
Thicknesses of nitrile rubber are minimum calculated thicknesses
Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.
The above thicknesses relate to Class O rated insulated. The thicknesses may vary for other ratings.

For trace heated HWS pipework for temperature maintenance, the thicknesses shall be adjusted (as advised by the trace heating specialist) to ensure the correct combination of thermal insulation (thermal conductivity / thickness) and heating cable (ie output / straight or double or spiral) to meet the design parameters in schedule Y24

2306 NON-DOMESTIC HOT WATER SERVICE AREAS, BUILDING REGULATIONS - NITRILE RUBBER:

Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Approx. thickness of nitrile rubber (mm)	
Surface emissivity	(0.05)	(0.9)
17	26	31
21	28	33
27	30	35
34	32	37
42	33	38
48	35	41
60	36	42
76	38	44
89	38	44
114	39	45
140	40	47
168	41	48
219	41	48
273 and above	42	49

Basis: Horizontal pipe at 60°C in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
Thicknesses of nitrile rubber are minimum calculated thicknesses.

Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.
The above thicknesses relate to Class O rated insulation. The thicknesses may vary for other ratings.

2307 NON-DOMESTIC HOT WATER SUPPLY SERVICES, ECA ENHANCED:

The insulation manufacturer selected for a particular project should calculate the minimum required thicknesses of pipework insulation based on the actual conductivity of the product at the relevant temperature and the criteria on the ECA web site for an eligible installation using the methodology set out in BS EN ISO 12241and the assumptions set out in Table C1 of BS 5422: 2009. The table below defines the maximum permissible heat losses to be used in the calculations.

Non-Domestic Hot Water Supply Maximum Permitted Heat Loss (W/m)	
Temperature	60°C
Outside Pipe Diameter (mm)	
17.2	6.04
21.3	6.45
26.9	7.00
33.7	7.71
42.4	8.46
48.3	9.01
60.3	9.94
76.1	11.25
88.9	12.17
114.3	14.29
139.7	16.09
168.3	18.24
219.1	22.06
273 & above	25.95

2308 DOMESTIC HOT WATER STORAGE VESSELS IN NEW AND EXISTING BUILDINGS- ROCK MINERAL WOOL:

Provide insulation thicknesses to limit heat losses from DHW storage vessels to the maximum recommended in Table 27 in the Non-domestic Building Services Compliance Guide (NDBSCG):2013.
Minimum thickness of insulation for vessels of capacity less than those in the table below to be 80mm.
Insulation thickness for vessels with capacity greater than $2m^3$ to be 120mm.
Install insulation in accordance with the manufacturer's recommendations.
Encase insulation in 1.6mm thick galvanised mild steel sheets.

Nominal Capacity (litres)	Typical vessel Diameter (m)	Typical vessel Height or length(m)	Maximum Heat Loss (kWh/24h)	kW	W/m^2	Rock mineral wool slab thickness mm
700	0.675	1.750	4.1	0.171	38.6	80
800	0.750	1.950	4.3	0.179	32.7	90
900	0.800	2.000	4.5	0.188	31.1	100
1000	0.850	1.950	4.7	0.196	30.9	100
1200	0.900	2.100	4.9	0.204	28.3	100
1500	1.050	1.950	5.1	0.213	26.0	110
2000	1.050	2.500	5.2	0.217	21.7	120

Basis of table: Part of Table 27 in NDBSCG:2013, rock mineral wool slabs (plain, without foil facing) conforming to BS EN 14303, $45Kg/m^3$ and thermal conductivity of 0.042W/mK at 50°C mean temperature.

2311 NON DOMESTIC HEATING SYSTEMS BUILDING REGULATIONS [INTERNAL PIPEWORK] ROCK MINERAL WOOL

Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F2, and section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of rock mineral wool insulation (mm)					
Temperature of contents °C	≤95		96-120		121-150	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	25	30	25	30	25	30
21	30	35	30	35	30	35
27	35	40	40	45	40	45
34	35	40	45	55	55	55
42	35	40	55	60	65	70
48	40	45	55	60	70	75
60	40	45	60	65	75	80
76	45	50	60	65	80	90
89	45	50	65	70	80	90
114	50	55	65	75	90	100
140	50	55	70	75	100	100
168	50	55	70	80	100	100
219	50	60	75	80	100	120
273 & above	50	60	75	90	110	120

Basis of calculation of thicknesses: Horizontal pipe at 75 ^{o}C (LTHW) or 100 ^{o}C (MTHW) or 125 ^{o}C (HTHW) in still air at 15 ^{o}C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

Use this table for insulation thickness of copper or plastic pipework of the nearest equivalent outside diameter.

2312 NON DOMESTIC HEATING SYSTEMS [EXTERNAL PIPEWORK] MINERAL WOOL INSULATION LOW EMISSIVITY OUTER SURFACE (0.05):

Minimum insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide

Nominal Steel Pipe Size (bore - mm)	Temperature of contents ^{0}C
	75 (Low temperature hot water)
	Thickness of Rock mineral wool insulation (mm)
10	60
15	60
20	60
25	60
32	60
40	70
50	70
65	70
80	70
100	70
125	70
150	70
200	70
250 & above	70
Flat Surfaces	70

The thicknesses tabled are the nearest commercial equivalent to calculated thicknesses based on: Horizontal pipe with water at 75^{0}C (LTHW) in still air at -5^{0}C.Use this table for insulation thickness of copper pipework of the nearest equivalent diameter.
Use this table for insulation thickness of copper pipework of the nearest equivalent diameter.

2315 NON DOMESTIC HEATING SYSTEMS BUILDING REGULATIONS [INTERNAL PIPEWORK] GLASS MINERAL WOOL

Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F2, and section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of rock mineral wool insulation (mm)					
Temperature of contents °C	≤95		96-120		121-150	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	25	30	25	30	25	30
21	30	40	30	40	30	40
27	30	40	40	40	40	40
34	40	40	50	50	50	50
42	40	40	50	50	60	60
48	40	50	50	60	60	80
60	40	50	60	60	80	80
76	50	50	60	60	80	80
89	50	50	60	80	80	80
114	50	50	60	80	80	100
140	50	60	80	80	100	100
168	50	60	80	80	100	100
219	50	60	80	80	100	100
273 & above	50	60	80	80	100	100

Basis of calculation of thicknesses: Horizontal pipe at 75 ºC (LTHW) or 100 ºC (MTHW) or 125 ºC (HTHW) in still air at 15 ºC. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
Use this table for insulation thickness of copper or plastic pipework of the nearest equivalent outside diameter.

2325 NON DOMESTIC HEATING SYSTEMS BUILDING REGULATIONS [INTERNAL PIPEWORK]- PHENOLIC FOAM INSULATION:

Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F2, and section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of phenolic foam insulation (mm)	
Temperature of contents °C	≤95	
Surface emissivity	0.05	0.9
17	15	15
21	15	20
27	20	20
34	20	20
42	20	25
48	25	25
60	25	25
76	25	30
89	25	30

114	30	30
140	30	35
168	30	35
219	30	35
273 &above	35	35

Basis of calculation of thicknesses: Horizontal pipe at 75 °C (LTHW) or 100 °C (MTHW) or 125 °C (HTHW) in still air at 15 °C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
Use this table for insulation thickness of copper or plastic pipework of the nearest equivalent outside diameter.

2325A NON DOMESTIC HEATING SYSTEMS [EXTERNAL PIPEWORK] PHENOLIC FOAM INSULATION LOW EMISSIVITY OUTER SURFACE (0.05):

Minimum insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide

Nominal Steel Pipe Size (bore - mm)	Temperature of contents ^{0}C
	Low temperature hot water 75^{0}C
	Thickness of phenolic foam insulation (mm)
10	30
15	30
20	35
25	35
32	35
40	40
50	40
65	45
80	45
100	45
125	45
150	50
200	50
250 & above	50
Flat Surfaces	50

The thicknesses tabled are the nearest commercial equivalent to calculated thicknesses based on: Horizontal pipe with water at 75^{0}C (LTHW) in still air at -5^{0}C.Use this table for insulation thickness of copper pipework of the nearest equivalent diameter.
Use this table for insulation thickness of copper pipework of the nearest equivalent diameter.
Basis: Aged k- value

2326 NON DOMESTIC HEATING SYSTEMS BUILDING REGULATIONS [INTERNAL PIPEWORK]- NITRILE RUBBER INSULATION:

Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of nitrile rubber insulation (mm)					
Temperature of contents °C	≤95		96-120#		121-150#	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	27	31	26	29	32	35
21	31	36	32	36	38	42
27	34	39	40	45	48	52
34	36	42	47	52	59	65

42	38	44	51	57	74	81
48	40	46	52	58	77	84
60	42	48	56	62	82	89
76	44	50	59	66	87	95
89	45	52	61	67	90	98
114	47	54	65	71	96	103
140	48	55	68	74	100	107
168	49	56	70	77	102	110
219	51	58	72	79	106	115
273	51	58	74	81	109	118

Thicknesses of nitrile rubber are minimum calculated thicknesses.
Basis: Horizontal pipe at 75°C (LTHW) or 100°C (MTHW) or 125°C (HTHW) in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
Use this table for insulation thickness of copper or plastic pipework of the nearest equivalent outside diameter.
for service temperatures above 110°C specialist high temperature Foamed EPDM rubber must be used as recommended by the manufacturer.

2327 NON-DOMESTIC HEATING INSTALLATIONS, ECA ENHANCED:

The insulation manufacturer selected for a particular project should calculate the minimum required thicknesses of pipework insulation based on the actual conductivity of the product at the relevant temperature and the criteria on the ECA web site for an eligible installation using the methodology set out in BS EN ISO 12241and the assumptions set out in Table C1 of BS 5422: 2009. The table below defines the maximum permissible heat losses to be used in the calculations.

Non-Domestic Heating Installations Maximum Permitted Heat Loss (W/m)			
	Low	Medium	High
Temperature	< 95°C	96-120°C	121-150°C
Outside Pipe Diameter (mm)			
17.2	7.78	10.57	13.27
21.3	8.42	11.25	14.06
26.9	9.05	12.06	15.02
33.7	9.86	13.04	16.07
42.4	10.83	14.12	17.34
48.3	11.42	14.80	18.09
60.3	12.61	16.22	19.62
76.1	14.12	17.88	21.41
88.9	15.28	19.20	22.87
114.3	17.51	21.66	25.53
139.7	19.72	23.99	27.98
168.3	22.34	26.63	30.69
219.1	26.61	31.15	35.25
273 & above	30.91	35.83	40.05

2331 DOMESTIC CENTRAL HEATING AND HOT WATER SYSTEMS ROCK & GLASS MINERAL WOOL INSULATION:

Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F1, and section 6 of the Scottish Domestic Technical Handbook.

Outside diameter of copper pipe (mm)	Thickness of rock mineral wool (mm)		Thickness of glass mineral wool (mm)	
Surface emissivity	0.05	0.9	0.05	0.9
15	-	-	20	20
22	20	20	20	20

28	20	25	20	20
35	20	25	20	25
42	20	25	20	25
54	20	25	20	25

Basis of calculation: Horizontal pipe at 60^{O}C (LTHW) in still air at 15^{O}C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
Mineral wool sections are not available for pipe outside diameters less than 17mm.
Use this table for insulation thickness for plastic pipework of the nearest equivalent outside diameter.

2332 DOMESTIC CENTRAL HEATING AND HOT WATER INSTALLATIONS, ECA ENHANCED:
The insulation manufacturer selected for a particular project should calculate the minimum required thicknesses of pipework insulation based on the actual conductivity of the product at the relevant temperature and the criteria on the ECA web site for an eligible installation using the methodology set out in BS EN ISO 12241 and the assumptions set out in Table C1 of BS 5422: 2009. The table below defines the maximum permissible heat losses to be used in the calculations.

Domestic Heating & Hot Water Maximum Permitted Heat Loss (W/m)	
Temperature	60^{o}C
Outside Pipe Diameter (mm)	
8	5.82
10	6.20
12	6.52
15	7.03
22	8.02
28	8.87
35	9.63
42	10.58
54	11.83

2336 DOMESTIC CENTRAL HEATING AND HOT WATER SYSTEMS - PHENOLIC FOAM
Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F1 and section 6 of the Scottish Domestic Technical Handbook.

Outside diameter of copper pipe (mm)	Thickness of phenolic foam insulation (mm)	
Surface emissivity	0.05	0.9
15	15	15
22	15	15
28	15	15
35	15	15
42	15	15
54	15	15

Basis: Horizontal pipe, water at 60°C in still air at 15°C, aged k value. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

2337 DOMESTIC CENTRAL HEATING AND HOT WATER SYSTEMS – NITRILE RUBBER
Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F1 and section 6 of the Scottish Domestic Technical Handbook.

Outside diameter of copper pipe (mm)	Thickness of nitrile rubber insulation (mm)	
Surface emissivity	0.05	0.9

8	9	9
10	13	13
12	13	19
15	19	19
22	19	25
28	19	25
35	25	25
42	25	25
54	25	32

Basis: Horizontal pipe, water at 60°C in still air at 15°C, aged k value. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

2340 STEAM AND CONDENSATE SYSTEMS FOR HVAC SYSTEMS - ROCK MINERAL WOOL:

Outside diameter of steel pipe (mm)	Thickness of rock mineral wool insulation (mm)					
Temperature of contents °C	Condensate ≤100°C #		Steam & Condensate Up to 149°C ## (3.6 barg max)		Steam & Condensate 150°C and above ###	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	25	30	25	30	45	50
21	30	35	30	35	55	70
27	40	45	40	45	75	80
34	45	55	55	55	90	100
42	55	60	65	70	120	120
48	55	60	70	75	120	120
60	60	65	75	80	120	130
76	60	65	80	90	130	140
89	65	70	80	90	130	140
114	65	75	90	100	140	140
140	70	75	90	100	140	150
168	70	80	100	100	140	150
219	75	80	100	120	150	150
273	75	90	100	120	150	160
Flat surfaces	75	90	100	120	150	160

Basis of calculation of thicknesses: BS 5442 Table 16 Horizontal pipe at 100°C in still air at 15°C, high emissivity outer surface (0.9). Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
Basis of calculation of thicknesses: BS 5442 Table 16 Horizontal pipe at 125°C in still air at 15°C, high emissivity outer surface (0.9). Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
Basis of calculation of thicknesses: BS 5442 Table 16 Horizontal pipe at 150°C (but using heat losses for 125°C) in still air at 15°C, high emissivity outer surface (0.9). Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
These thicknesses are greater than those for process pipework with a hot face temperature of 200°C to control heat loss and limit surface temperature. (Tables 21 and 24 in BS 5224).
Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

2395 COOLED WATER SUPPLIES, BUILDING REGULATIONS, HEAT GAIN AND CONDENSATION CONTROL ON COOLED AND COLD WATER SUPPLIES - ROCK MINERAL WOOL:
Insulation thicknesses are the worst case to control heat gain to maximum permissible figures stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F2, and section 6 of the Scottish Non Domestic Technical Handbook and control condensation in accordance with BS 5442.

Outside diameter of steel pipe (mm)	Thickness of mineral wool insulation (mm)

Temperature of contents °C	>10		4.9 to 10		0 to 4.9	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	20	20	25	25	30	30
21	20	20	25	25	30	30
27	20	20	30	30	35	30
34	20	25	30	30	35	35
42	25	25	30	30	40	35
48	25	25	35	30	40	35
60	25	25	35	35	45	40
76	30	30	40	35	50	45
89	30	30	40	35	50	45
114	30	30	45	35	55	45
140	35	30	45	40	55	45
168	35	30	50	40	60	45
219	35	30	50	40	65	45
273	40	30	55	40	70	45
324	40	40	55	45	70	60
356	40	40	60	50	75	60
406	45	50	60	60	75	70
456	45	60	60	70	80	80
508	45	60	65	80	80	90
610	50	80	70	90	90	110
Flat	50	80	70	90	90	110

Basis for condensation: control ambient temperature of 25°C and a relative humidity of 80%. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.

2396 COOLED WATER SUPPLIES, BUILDING REGULATIONS, HEAT GAIN AND CONDENSATION CONTROL ON COOLED AND COLD WATER SUPPLIES – GLASS MINERAL WOOL:
Insulation thicknesses are the worst case to control heat gain to maximum permissible figures stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F2, and section 6 of the Scottish Non Domestic Technical Handbook and control condensation in accordance with BS 5442.

Outside diameter of steel pipe (mm)	Thickness of glass mineral wool insulation (mm)					
Temperature of contents °C	>10		4.9 to 10		0 to 4.9	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	20	20	20	25	25	25
21	20	20	25	25	30	30
27	20	20	25	25	30	30
34	20	20	25	30	40	30
42	20	20	30	30	40	40
48	25	25	30	30	40	40
60	25	25	30	30	50	40
76	25	25	40	40	50	40
89	25	25	40	40	50	40
114	30	30	40	40	50	40
140	30	30	40	40	50	40
168	30	30	40	40	60	50
219	40	30	50	40	60	50
273	40	30	50	40	60	50
324	40	40	50	45	60	60
356	40	40	50	50	60	60
406	40	50	60	60	80	70
456	40	60	60	60	80	80
508	40	60	60	80	80	90
610	40	80	60	80	80	100

Flat	50	80	60	90	80	100

Basis for condensation: control ambient temperature of 25°C and a relative humidity of 80%. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.

2411 COOLED WATER SUPPLIES, BUILDING REGULATIONS, HEAT GAIN AND CONDENSATION CONTROL ON COOLED AND COLD WATER SUPPLIES – PHENOLIC FOAM:

Insulation thicknesses are the worst case to control heat gain to maximum permissible figures stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F2, and section 6 of the Scottish Non Domestic Technical Handbook and control condensation in accordance with BS 5442.

Outside diameter of steel pipe (mm)	Thickness of phenolic foam insulation (mm)					
Temperature of contents °C	>10		4.9 to 10		0 to 4.9	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	15	15	20	15	25	20
21	15	15	20	15	25	20
27	15	15	20	20	25	20
34	20	15	25	20	30	20
42	20	15	25	20	30	25
48	20	20	25	20	30	25
60	20	20	25	25	35	25
76	20	20	30	25	35	30
89	20	20	30	25	40	30
114	25	20	35	25	40	30
140	25	20	35	25	45	30
168	25	20	35	25	45	30
219	30	20	40	30	50	35
273	30	25	40	30	50	35
324	30	25	40	30	55	35
356	30	25	45	30	55	35
406	30	25	45	30	55	35
456	35	25	45	30	60	35
508	35	25	45	30	60	35
610	35	25	50	30	65	35

Basis for condensation: control ambient temperature of 25°C and a relative humidity of 80%. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures, Aged k value.
Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.

2412 COOLED WATER SUPPLIES, BUILDING REGULATIONS, HEAT GAIN AND CONDENSATION CONTROL ON COOLED AND COLD WATER SUPPLIES – NITRILE RUBBER:

Insulation thicknesses are the worst case to control heat gain to maximum permissible figures stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F2, and section 6 of the Scottish Non Domestic Technical Handbook and control condensation in accordance with BS 5442.

Outside diameter of steel pipe (mm)	Thickness of nitrile rubber insulation (mm)					
Temperature of contents °C	>10		4.9 to 10		0 to 4.9	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	15	21	20	26	23	30
21	16	22	21	27	24	31
27	17	23	23	29	2	33
34	18	25	24	31	29	36
42	19	26	25	32	30	38
48	20	27	26	33	31	39

60	20	27	27	35	33	40
76	21	28	28	37	37	45
89	21	29	29	37	37	45
114	22	30	29	37	37	45
140	22	30	30	38	37	45
168	22	30	30	39	38	47
219	22	31	30	39	38	47
273	22	31	30	39	38	47
324	25	35	30	40	40	50
356	25	35	35	40	40	50
406	25	40	35	40	45	50
456	25	40	35	40	45	50
508	25	40	35	40	45	50
610	25	40	35	40	45	50

Basis for condensation: control ambient temperature of 25°C and a relative humidity of 80%. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.
Thicknesses of nitrile rubber are minimum calculated thicknesses

2372 CHILLED AND MAINS COLD WATER SUPPLIES THICKNESS TABLE [EXTERNAL PIPEWORK] To prevent condensation and control heat gain to maximum permissible figures stated in building regs part l non domestic building services compliance guide - mineral wool low emissivity outer surface (0.05):

Minimum insulation thickness with an ambient air temperature of 30^0C and relative humidity of 80%

Nominal Steel Pipe Size (bore - mm)	Temperature of contents ^{0}C			
	>10		5-10	
	Thickness of mineral wool insulation (mm)			
	Rock	Glass	Rock	Glass
10	30	30	60	50
15	30	30	60	50
20	30	30	50	50
25	40	30	50	50
32	40	40	50	50
40	40	40	50	50
50	40	40	50	50
65	40	40	50	50
80	40	40	50	50
100	40	40	50	50
125	40	40	50	50
150	40	40	50	50
200	50	50	50	60
250	50	50	50	60
300	50	50	60	60
350	50	50	60	60
400	50	50	60	70
450	50	50	60	70
500	60	60	60	70
Flat Surfaces	60	60	70	70

Use this table for insulation thickness of copper or plastic pipework of the nearest equivalent diameter.
Thicknesses relate to class O rated insulation.

2420 PROTECTION AGAINST FREEZING – ROCK MINERAL WOOL:

Outside diameter of	Indoor condition where freezing might occur	Outdoor condition where freezing might occur

pipe (mm)		
	Thickness of mineral wool insulation (mm)	
Copper		
15	-	-
22	20	50
28	20	25
35	20	20
42	20	20
54	20	20
76	25	25
108	25	25
Steel		
21	40	-
27	20	45
34	20	25
42	20	20
48	20	20
60	20	20
76	25	25
89	25	25

Basis BS 5422 Table 29: Initial water temperature +2°C, evaluation period 12hrs thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
If mineral wool is used on pipes smaller than 20mmNB the required insulation thickness is too large to be applied in practice. To provide the appropriate degree of frost protection a combination of insulation and trace heating will be required.

Indoor condition is for ambient air temperature of -6^{O}C, permitted ice formation of 50%.

Outdoor condition is for ambient air temperature of -10^{O}C, permitted ice formation of 50%.

2421 PROTECTION AGAINST FREEZING – GLASS MINERAL WOOL:

Outside diameter of pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
	Thickness of glass mineral wool insulation (mm)	
Copper		
15	-	-
22	25	60
28	20	30
35	20	20
42	20	20
54	20	20
20	20	20
108	20	20
Steel		
21	50	-
27	25	40
34	20	20
42	20	20
48	20	20
60	20	20
76	20	20

89	20	20

Basis BS 5422 Table 29: Initial water temperature +2°C, evaluation period 12hrs thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
If mineral wool is used on pipes smaller than 20mmNB the required insulation thickness is too large to be applied in practice. To provide the appropriate degree of frost protection a combination of insulation and trace heating will be required.

Indoor condition is for ambient air temperature of -6^{O}C, permitted ice formation of 50%.

Outdoor condition is for ambient air temperature of -10^{O}C, permitted ice formation of 50%.

2430 PROTECTION AGAINST FREEZING - PHENOLIC FOAM:

Outside diameter of pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
	Thickness of closed cell phenolic foam (mm)	
Steel		
21	30	75
27	15	30
34	15	20
42	15	15
48	15	15
60	15	15
76	15	15
89	15	15
Copper		
15	35	130
22	15	30
28	15	20
35	15	15
42	15	15
54	15	15
76	15	15
108	15	15

Basis BS 5422 Table 29: Initial water temperature +2°C, evaluation period 12hrs, thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

Indoor condition is for ambient air temperature of -6^{O}C, permitted ice formation of 50%.

Outdoor condition is for ambient air temperature of -10^{O}C, permitted ice formation of 50%.
Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

2440 PROTECTION AGAINST FREEZING - CLOSED CELL NITRILE RUBBER:

Outside diameter of pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
	Thickness of closed cell nitrile rubber (mm)	
Steel		
21	54	-
27	21 25)	59
34	13(13)	31(35)
42	7(9)	17(19)
48	4(6)	10(13)
60	2(6)	6(6)
76	(6)	3(6)
89	(6)	2(6)

Copper		
15	84	-
22	18	59
28	10	31
35	6	17
42	6	10
54	6	6
76	6	6
108	6	6

Basis BS 5422 Table 29: Initial water temperature +2°C, evaluation period 12hrs, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
If nitrile runner is used on pipes smaller than 20mmNB for the outdoor condition, the required insulation thickness is too large to be applied in practice. To provide the appropriate degree of frost protection a combination of insulation and trace heating will be required.
Figures (xx) are nearest commercially available material thicknesses. Greater thicknesses to be achieved by layering of insulation.
Indoor condition is for ambient air temperature of -6^{O}C, permitted ice formation of 50%.
Outdoor condition is for ambient air temperature of -10^{O}C, permitted ice formation of 50%.
Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

2456 INSULATION THICKNESS ON DUCTWORK, BUILDING REGULATIONS:

Insulation thickness to limit heat gains and heat losses stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of the Scottish Non Domestic Technical Handbook.

Material	Thickness of insulation (mm)					
	Warm air ductwork			Chilled air / dual purpose ductwork		
Surface Emissivity	Low (0.05)	Med (0.44)	High (0.9)	Low (0.05)	Med (0.44)	High (0.9)
Rock Mineral wool (Ductwrap)	40	40	40	50	60	70
Glass mineral wool	40	40	40	50	60	60
Phenolic foam	20	25	25	35	40	40
Nitrile rubber	32	37	40	51	60	62

Basis:
Warm air ductwork - horizontal duct at 35°C with 600 mm vertical sidewall in still air at 15 °C.
Chilled air ductwork - horizontal duct at 13°C with 600 mm vertical sidewall in still air at 25 °C
Thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
Thicknesses of mineral wool and phenolic foam are the nearest commercially available thickness to meet minimum requirements.
Thicknesses of nitrile rubber are minimum thicknesses.

2475 CONDENSATION CONTROL ON CHILLED AIR DUCTWORK :

Insulation thickness for condensation control on ductwork carrying chilled air in ambient conditions: indoor still air temperature 25°C, relative humidity 80%, dew point temperature 21.3°C.
All ductwork shall be insulated where were visible (ie exposed ductwork) when the duct surface temperature is below the dew point of the air within the space served.

Surface emissivity	Low (0.05)				Medium (0.44)				High (0.9)			
Material	MW	GW	PF	NF	MW	GW	PF	NF	MW	GW	PF	NF
Min air temp inside duct°C												
15	30	25	20	12	25	25	20	-	25	25	20	6
10	50	40	30	21	25	25	20	-	25	25	20	11
5	70	50	50	31	40	40	25	-	25	25	20	17
0	90	50	60	40	50	50	30	-	30	40	20	22

MW – Mineral Wool, GW – Glass mineral wool, PF – Phenolic foam, NF – FEF nitrile foam

Basis: Table 12 in BS 5422, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
All ductwork shall be insulated where were visible (i.e exposed ductwork) when the duct surface temperature is below the dew point of the air within the space served.
Thicknesses of nitrile rubber are minimum thicknesses.

2490 THICKNESS OF INSULATION TO BS 5422 FOR PROCESS PIPEWORK AND EQUIPMENT:

The process plant manufacturer or specialist pipework installer shall select the appropriate insulation material.
Comply with the requirements of sections 4 and 10 and relevant annexes of BS 5422 and supply minimum thickness of insulation for services in accordance with relevant tables in BS 5422 to control heat loss or limit surface temperature to suit the system operating temperature and insulation material thermal conductivity.
Table 21 - Minimum insulation thickness for process pipework and equipment to control heat loss.

2495 THICKNESS OF INSULATION TO BS 5422 FOR REFRIGERATION PIPEWORK AND EQUIPMENT:

The chiller or refrigeration plant manufacturer or specialist refrigeration pipework installer shall select the appropriate insulation material for the application.
To control heat gain and condensation, comply with the requirements of section 6 of BS 5422 and supply minimum thickness of insulation in accordance with relevant tables below and Annexes F and H in BS 5422 to suit the system operating temperature and insulation material thermal conductivity.
Table 1 – Maximum permitted water vapour permeance in relation to plant temperature at an ambient temperature of +20°C (dry bulb).
Table 4 – Minimum insulation thickness for refrigeration applications to control condensation and control heat gain on a high emissivity outer surface (0.90) with an ambient temperature of +25°C and a relative humidity of 80%.
Table 5 – Minimum insulation thickness for refrigeration applications to control condensation and control heat gain on a low emissivity outer surface (0.05) with an ambient temperature of +25°C and a relative humidity of 80%.

3000 WORKMANSHIP

3011 GENERAL:

Install insulation in accordance with BS 5970.
Carry out thermal insulation work using a specialist firm employing skilled craftsmen conversant with class of work, being members of the Thermal Insulation Contractors Association.
Do not apply thermal insulation until installation has been fully tested and all joints proved sound.
Ensure all materials are kept dry.
Ensure all pipework surfaces are dry before the installation of thermal insulation.
Where systems are to be lagged, insulate all of the items on the system (eg plenum box) unless indicated otherwise.
Separation

Insulate each unit separately. Do not enclose adjacent units together.

Clearance

Ensure clearance between insulated pipes.

Application

Apply insulants, facings, coatings and protection strictly in accordance with manufacturer's instructions.

Finish

Neatly finish joints, corners, edges and overlaps and, where possible, arrange overlaps to fall on blind side.

Ensure overlaps are neat and even and parallel to circumferential and longitudinal joints.

All nameplates shall be covered with removable sections of insulation that are easily identifiable, or where practical, name plate is removed and repositioned on the outer face of the insulation.

The insulation shall be applied such that plant and equipment can be cleaned and inspected with allowance made for removal of access covers, bolts, nuts and probes without damage to the insulation.

Care shall be taken to ensure that where required, a complete vapour seal is maintained. In particular, the insulation to and around the points where supports, brackets and hangers occur on vapour sealed services shall ensure provision of a complete barrier to moisture transmission.

All exposed ends of insulation shall be sealed to prevent migration of fibres and then capped with suitable protective capping adequately fixed.

Where an insulated pipe/duct passes through an external building element adequate precautions shall be taken to prevent entry of the rain water into the building.

In instances where phenolic foam sections are applied to copper pipework, the pipework shall be clean and dry prior to the application of the insulation. Care shall be taken to ensure that in all cases where there is a likelihood of the copper pipework coming into contact with raw foam, a bore coating is incorporated into the phenolic foam.

Insulation shall be protected during the progress of the work and maintained dry.

NOTE:

Attention is drawn to the risk attached to the use of PIB, polyurethane, PVC, polystyrene, isocyanurates etc., even where these materials are claimed to be fire resistant and/or self-extinguishing, they have proved in the past to produce toxic smoke causing a hazard to persons working in the area and to fire fighting teams. These types of insulation or finish **shall not** be used inside of a building or areas under cover. PIB may be used external to the building only where indicated.

3020 INSTALLATION OF FOIL FACED MINERAL WOOL INSULATION ON PIPEWORK:

Ensure joints are close butted together. Secure overlaps with adhesive or matching class ‘O’ tape, a minimum of 50mm wide, on both longitudinal and circumferential butt joints. Insulate fittings to same standard as adjacent pipework and use mitred segments where necessary, taped as above.

Where a vapour seal or fibre containment is required tape exposed insulation membrane and return to pipe surface.

Where insulation abuts pipe support inserts that have integral vapour barriers seal using ‘O’ tape to continue vapour barrier or containment.

3030 INSTALLATION OF FOIL FACED PHENOLIC FOAM INSULATION ON PIPEWORK:

Ensure joints are close butted together. Secure overlaps with adhesive or matching class ‘O’ tape, a minimum of 50mm wide, on both longitudinal and circumferential butt joints. Insulate fittings to same standard as adjacent pipework and use mitred segments where necessary, taped as above. Ensure the passivating internal bore coating of the insulation is not damaged, particularly at corners and other irregular shapes.

Before phenolic resin foam sectional insulation is applied, ensure that all pipework is clean, dry and free of any debris or corrosive substances such as excess soldering flux, building materials.

Installation shall be by a contractor approved by the manufacturers strictly in accordance with the manufacturer’s installation instructions.

3040 INSTALLATION OF INSULATION ON PIPEWORK - WITH CANVAS FINISH:

Ensure joints are close butted together and secure overlaps with adhesive and smooth out. Insulate fittings to same standard as adjacent pipework and use mitred segments where necessary. Secure with adhesive using a minimum of 50mm wide canvas to cut mitred joints. Apply two coats of class "O" polymer solution.

3050 INSTALLATION OF CLOSED CELL NITRILE RUBBER INSULATION ON PIPEWORK:

Install closed cell nitrile rubber in accordance with manufacturer's recommendations.

Check installation procedure when closed cell nitrile rubber is to be installed on stainless steel pipework.

3060 INSTALLATION OF FOIL FACE SEMI-RIGID SLAB INSULATION ON DUCTWORK:

Secure the insulation with adhesive in accordance with manufacturer's recommendations. Use insulation hangers spaced at maximum 300mm centres on the underside of ducts.

Cut slabs so that the top and bottom pieces overlap the sides. Seal joints and pin penetrations using 100mm wide class 'O' aluminium foil tape. Where cut outs for test holes, etc occur tape over insulation membrane and return to the duct surface.

Where insulation abuts duct support inserts that have integral vapour barriers seal use class 'O' foil tape to continue vapour barrier.

3070 INSTALLATION OF FOIL FACED FLEXIBLE DUCTWORK INSULATION:

Secure the insulation with adhesive in accordance with manufacturer's recommendations. Use insulation hangers spaced at maximum 300mm centres on the underside of rectangular and flat oval ducts.

Seal joints and pin penetrations using 100mm wide class 'O' aluminum foil tape. Where cut outs for test holes, etc occur tape over insulation membrane and return to the duct surface.

Where insulation abuts duct support inserts that have integral vapour barriers use class 'O' foil tape to continue vapour barriers.

3080 INSTALLATION OF FOIL FACED LAMELLA OR CRIMPED MAT ON DUCTWORK:

Secure the insulation with adhesive in accordance with manufacturer's recommendations. Use insulation hangers spaced at maximum 300mm centres on the underside of rectangular and flat oval ducts.

Seal joints and pin penetrations using 100mm wide class 'O' aluminum foil tape. Where cut outs for test holes, etc occur tape over insulation membrane and return to the duct surface.

Where insulation abuts duct support inserts that have integral vapour barriers use class 'O' foil tape to continue vapour barriers.

3090 INSTALLATION OF INSULATION ON TANKS:

Fit insulation so that two opposite pieces overlap the sides. Bond insulation to the tank with adhesive, applied in accordance with the manufacturer's recommendations. Closely butt together all slabs and seal joints with a matching self adhesive tape 100mm wide.

3101 INSTALLATION OF MINERAL WOOL INSULATION ON VESSELS:

Cut Lamella or crimped mat to length to wrap around vessel with an additional 75mm to form an overlap. Remove insulation from facing of overlap together with dust, and seal overlap with adhesive in accordance with manufacturer's instructions. Butt joints closely together and seal with matching self-adhesive tape at least 100mm wide.

On heat exchangers and HWS calorifiers in plant rooms, domed tops of calorifiers shall be finished in 0.9mm stucco embossed aluminium sheeting in coned segmental tops.

Manway chests shall be enclosed in removable stucco embossed covers lined with mineral fibre mattresses of 66 - 100 kg/M3 density, flanges and end covers on heat exchangers shall be similarly treated.

3102 INSTALLATION OF INSULATION ON FLANGED TANKS:

Insulate with an initial layer of 40mm thick plain mineral fibre slabs (nominal density 45 kg/m^3) secured by approved adhesive and stick pins, followed by a further layer of 40mm thick mineral fibre slabs (nominal density 45 kg/m^3), secured to first layer by an approved adhesive and previously applied stick pins. This shall then present a uniform thickness at minimum of 40mm. Finish to insulation shall be factory applied reinforced aluminium foil laminate, joints in surface covering to be secured with 100mm wide plain soft aluminium foil self adhesive tape to maintain a vapour barrier. Particular attention shall be paid to the vapour barrier where self adhesive stick pins protrude through the mineral fibre insulation and its factory applied finish. (2nd layer).
Final finishes shall be as scheduled.

3105 INSULATION OF EXTERNAL DUCTWORK AND FLAT SIDED TANKS

On flat, oval or rectangular ductwork and flat sided tanks, build up the insulation on the top surface of the duct in order to provide a self draining surface. Minimum slope to be 1 in 10. Ensure average thickness for the side is equivalent to other sides and that at no point is the thickness below that required to avoid condensation.

3120 INSTALLATION OF POLYISOBUTYLENE (PIB) PROTECTION:

Wrap pipework and fittings, ductwork or tanks and vessels with PIB sheeting lapped at every joint by at least 50mm. Solvent weld joints in accordance with manufacturer's recommendations and arrange joints to shed water and prevent the ingress of water.

3125 INSTALLATION OF MULTI-LAYERED LAMINATE FOIL/FILM PROTECTION:

Install laminated foil/film protection, in accordance with manufacturer's instructions.
Installation may be either factory pre-applied or applied in-situ.
Ensure all surfaces are dry and clean, free from dust, oil and grease/silicone.
Arrange joints to give water shed with the lap facing down.

3131 INSTALLATION OF INSULATION ON PIPEWORK - WITH SHEET METAL FINISH:

Secure insulation with metal bands at each end of section and at maximum centres of 450mm. Ensure joints are close butted together. Insulate bends with mitred segments of insulation banded into position. Insulate fittings are to the same standard as the adjacent pipework. At bends on cold services the vapour barrier surface shall be protected with a suitable absorbing strip since it will be necessary to secure any swaged segments with pop rivets, ie. the vapour barrier shall be retained by bedding any rivets into the strip (eg: Class 'O' Armaflex tape). If exposed to weather, seal all joints with suitable mastic. Form sheet metal to fit tightly over the outer circumference of insulation with a longitudinal overlap of at least 40mm. Secure the outer part of overlap with self tapping screws or rivets at centres of not more than 150mm except on pipes with vapour barrier; or metal bands.
Ensure circumferential overlaps are at least 50mm, secured with self tapping screws or rivets. Make provision to accommodate expansion and contraction at intervals. Ensure all joints are lapped to shed liquids and seal all joints exposed to weather or spillage. Cover all bends and fittings with matching sheet metal, tailored to fit and sealed as appropriate. Fit pre-insulated, purpose-designed boxes to valves, flanges, etc.

3141 INSTALLATION OF SHEET METAL FINISH ON DUCTWORK, TANK AND VESSEL INSULATION:

Form sheet metal to fit tightly over the insulation with a longitudinal overlap of at least 40mm. Secure the outer part of overlap with self tapping screws or rivets at centres of not more than 150mm.
Ensure circumferential overlaps are at least 50mm, secured with self tapping screws or rivets. Make provision to accommodate expansion and contraction at intervals. Ensure all joints are lapped to shed liquids and seal all joints exposed to weather or spillage.

Ducting - Rectangular

The whole shall be enclosed in 0.9mm stucco embossed aluminium cladding applied in the form of lock formed strip and/or folded or flat sheeting. Care shall be taken to support as necessary the underside to minimise sagging. Cladding shall be fixed to support cladding which shall be taped to and continues the vapour barrier.

Ducting - Circular

The insulation shall be enclosed in a layer of reinforced aluminium foil, joints secured with 75mm wide soft aluminium foil self adhesive tape to maintain a vapour barrier. The whole shall be enclosed in

0.9mm stucco embossed aluminium sheeting, secured by matching aluminium straps and/or self seal rivets to avoid puncturing the vapour seal.
For low temperature ducting (below 10°C) mastic treatment shall be applied in the overlaps since rivets may puncture the vapour barrier.

3151 INSTALLATION OF PROTECTION:
Ensure that where protection is applied to insulation, the joints fall blind side and that all joints are made to shed water and sealed with waterproof tape, adhesive or joint sealant where appropriate.

3170 INSTALLATION OF PROTECTION - ALUMINIUM SHEETING:
Secure lapped joints (at least 40mm) by means of pop rivets at a maximum spacing of 150mm. For cold piping use matching aluminium straps at maximum spacing of 225mm. On piping operating below ambient temperature seal all joints against moisture. For external use make joints shed water and use sheets with treated surface.
Where `lockform' seams are used submit proposals for dealing with surfaces curved in three dimensions.

3185 APPLICATION OF WEATHER PROOF PAINTS:
Do not apply weather proof paints in ambient temperatures below 5°C

3190 INSTALLATION OF RIGID PVC PROTECTION
Apply rigid PVC sheet and pre-formed fittings directly to insulation with an overlap of at least 40mm on longitudinal and circumferential joints.
Secure longitudinal laps with plastic rivets at 150mm centres.
Ensure rigid PVC is not installed in contact with heat sources.

3210 FLANGES AND VALVES:
Cut back to allow removal of bolts and nuts, finish with neat bevel or use end caps.
Where boxes are used fit over insulation on adjacent piping. Ensure operation of valve remains unimpaired with box in place.

3220 LINERS:
Where load bearing insulation is required use segmental liners suitable for temperature. Fit insulant up to liner and carry facing across the pipe ring.

3231 INSTALLATION WHERE INSULATION IS CARRIED THROUGH PIPELINE SUPPORT:
For cold services ensure insulation is carried through.
For hot services ensure insulation is carried through as scheduled.
For load bearing insulation carry through insulation and finish.
For non-load bearing insulation on hot pipework close butt to section of load bearing finished material suitable for working temperature 100mm long.
For non-load bearing insulation on cold pipework, close butt to high density phenolic foam supports. Ensure the vapour barrier is maintained.

3240 INSTALLATION WHERE INSULATION IS NOT CARRIED THROUGH PIPEWORK OR DUCTWORK SUPPORT:
Provide end caps to match applied finish.

3241 PIPE SLEEVES:
Carry finished insulation including vapour barrier through pipe sleeve.

3242 PIPE SLEEVES THROUGH FIRE RATED PARTITIONS
Where the insulation is to be carried through the partition - thermally insulated proprietary fire sleeves shall be used tested in accordance with BS 476 or BS EN `366 to meet the fire rating of the partition. The sleeves shall be either:
“Rockwool” Fire Pro Insulated fire sleeves comprising a combination of mineral wool and graphite intumescent. or

BIS “Pacifyer” one piece stainless steel sleeve with an intumescent lining the full length and 3 bands of acoustic foam adhered to the bore of the sleeve. Where the insulation is required to carry through the wall or partition / vapour seal is required oversized mineral wool shall be fitted to the pipework with an oversized Pacifyre fitted over the mineral wool.

Installation shall be in accordance with the manufacturer’s requirements.

3250 INSTALLATION WHERE INSULATION IS CARRIED THROUGH DUCTWORK SUPPORT:
Provide insulation between duct and support using high-density phenolic foam or polyisocyanurate strips. Butt insulation to spacer and carry over finish by 40mm and tape joint. Provide a sheet metal protecting sleeve.

3251 DUCTWORK SUPPORTS:
On cold services, ensure insulation carried through between duct and support
Provide insulation between duct and support using high-density phenolic foam or polyisocyanurate blocks. Carry over finish by 40mm and tape joint. Provide a sheet metal protecting sleeve.
Where insulation not carried through between duct and support provide end caps or bevelled seal.

3252 DUCT SLEEVES:
Carry finished insulation through duct sleeves.

3255 VAPOUR BARRIERS
Vapour barrier shall be applied over insulation on services, plant etc, working at or below ambient temperatures and they shall be continuous, maintained dry, completed and sealed as a vapour barrier throughout before reducing the service to its working temperature.

The insulation at all support points shall be pre-formed load bearing inserts manufactured from hardwood, phenolic foam or other specified material, and to the same thickness as the adjacent insulation on each side of the brackets/support.
Each insert shall incorporate a bright aluminium foil covering to provide a vapour barrier to match that of the adjacent insulation.
The length/width of each insert shall protrude not less than 40mm on either side of the bracket/support.
The insulation either side of the brackets/support shall butt up tightly to the insert and the vapour barrier made continuous by taping the joints between the foil faces on the insulation and inserts with a minimum 50mm wide Idenden T303 Class 'O' foil tape.
For HTHW, steam and condensate pipework where roller and chairs form supports, a galvanised sheet steel protective sleeve shall be provided around the insert between the roller and the guide bracket (Phenolic foam shall not be used on HTHW and steam pipework or systems that exceed its temperature limit.
It is essential to maintain the integrity of vapour seals.

3260 LIQUID VAPOUR BARRIERS:
Apply vapour seal solution evenly by brush in accordance with manufacturer's instructions; use solution which dries to a colour distinctive from insulating material.

3270 INTEGRITY OF VAPOUR BARRIERS:
Where a vapour barrier is indicated ensure its integrity throughout.
Repair immediately any damage to vapour barriers and where such barriers have been applied off site, repair to manufacturer's instructions.
Where aluminium sheeting is used for protection submit proposals for securing sheeting without impairing the integrity of the vapour seal, for approval.

3280 WATER TANKS
Arrange insulation and finish to allow removal of access covers and/or tank top.

10000 Based on NES Y50 TEXT Dec 19

Y51 – Testing & Commissioning of Mechanical Services

1000 GENERAL

Undertake inspection and commissioning of the building services systems in accordance with The Building Regulations Approved Documents L1 & L2 and relevant CIBSE / BSRIA commissioning codes.

Where an existing system has been extended or modified, then, unless noted otherwise in the scope of works, the complete system shall be re-commissioned. For example if a new prime mover has been installed or the original prime mover up rated in an air or water system and the system has been extended to serve additional terminals.

Appoint a commissioning manager / Specialist Commissioning Agent and undertake Commissioning Management in accordance with CIBSE commissioning code M.

The Contractor shall review all designs to ensure that systems are commissionable in accordance with the codes of practice detailed in Y51. If additional facilities are required the Contractor shall advise the designer prior to commencing work on site.

Produce and issue a notice to the local authority at the end of the commissioning that shall declare that a commissioning plan has been produced and followed and the commissioning results confirm that the performance of the engineering systems is in accordance with the original design. Where deviations / excursions from the design have been agreed with the designers / and client these shall be documented in the notice.

During the commissioning stage systems shall not be left running / unattended without Contractor attendance on site eg overnight or during weekends. Should a component failure occur the engineering services shall be configured to safely shut down.

Where required carry out Seasonal Commissioning in accordance with clause Y51 3025 as defined in clause Y51 1002 (in accordance with the requirements of BREEAM if required) and scheduled in in A31sch1 or A31sch2 and Y51sch3.

For Dry Riser and Wet Rise firefighting mains; where identified elsewhere within this specification or required by the local fire brigade, comply with the requirements of BS 9990 Clause 7.2 for protection of buildings under construction.

BREEAM projects – requirements:

Refurbishment and Fit Out 2014 and BREEAM New Construction 2018 requirements

- Comply with Issue ID Man 04 Commissioning and Handover
- Comply with Issue ID Man 05 Aftercare
- Comply with Issue ID Ene 02 Energy Monitoring
- Comply with Issue ID Wat 02 Water Monitoring
- Comply with Issue ID Wat 03 Water Leak Detection
- Comply with Issue ID Pol 01 Impact of Refrigerants
- Refer to schedules and scope of works for project specific requirements.

1002 DEFINITIONS

The following definitions, some extracted from BSRIA Guides BG2/2010 and BG49/2013, and BREEAM New Construction 2018 and shall apply to all systems.

Capacity Tests

The proving that the capacity of installed plant and equipment items meets the specified duty.

Commissioning

The advancement of an installation from the stage of static completion to working order to specified requirements. For pipework distribution systems it includes the setting to work of an installation and the regulation of flow rates.

Design Criteria

The measurements and quantities selected as the basis for the design of a system.

Performance Criteria

The specified, numerically quantifiable, characteristics and tolerances to be achieved by the system.

Performance Testing

The proving that the installed system can maintain the specified, numerically quantifiable, characteristics and tolerances to be achieved by the system.

Fine Tuning

The adjustment of a system where usage and system proving has shown such a need.

Pre-Commissioning Checks

Specified systematic checking of a completed installation to establish its suitability for commissioning.

Pressure and Leakage Testing

The measurement and recording of pressure retention, and fluid losses or gains in the plant Equipment, distribution ways and terminals.

Regulation

The process of adjusting the rates of fluid flow in a distribution system to achieve specified values.

Setting to Work

The process of setting a static system into operation.

Static Completion

The state of the system, when it is installed in accordance with the drawings and specification, ie being clean and ready for setting to work. In the case of water systems this includes flushing, cleaning, pressure and leakage testing, filling and venting.

System Proving

Measuring, recording, evaluating and reporting on the seasonal performance of the systems against their design values.

Testing

The measurement and recording of specified quantifiable characteristics of an installation or parts thereof.
NOTE: This includes off-site testing.

Environmental testing

The measurement and recording of internal environmental conditions including temperature, humidity and noise levels (with artificial loads applied and using instruments independent of the BMS where indicated).
The measurement of external noise levels
Refer to scope of work and Y51sch2 for details.

Seasonal Commissioning or Commissioning – implementation (as defined in BREEAM 2018 NC for one credit)

For Complex systems with a specialist commissioning manager
The following seasonal commissioning responsibilities will be completed over a minimum 12 month period, once the building becomes occupied:

Complex systems with a specialist commissioning manager

- Identify changes made by the owner or operator that might have caused impaired or improved performance.

- Test all building services under full load conditions, i.e. heating equipment in mid-winter, cooling and ventilation equipment in mid-summer and under part load conditions (spring and autumn).
- Where applicable, carry out testing during periods of extreme (high or low) occupancy.
- Interview building occupants (where they are affected by the complex services) to identify problems or concerns regarding the effectiveness of the systems.
- Produce monthly reports comparing sub-metered energy performance to the predicted one.
- Identify inefficiencies and areas in need of improvement.
- Re-commission systems (following any work needed to serve revised loads), and incorporate any revisions in operating procedures into the operations and maintenance (O&M) manuals.

Where specialist building services systems such as fume cupboards, microbiological safety cabinets and a cold storage system are present then the assessor must ensure that these systems are included in the specialist commissioning agent's responsibilities

Simple systems (naturally ventilated) – with an external consultant/facilities manager.

- Review thermal comfort, ventilation, and lighting, at three, six and nine month intervals after initial occupation, either by measurement or occupant feedback.
- Identify deficiencies and areas in need of improvement.
- Re-commission systems and incorporate any relevant revisions in operating procedures into the O&M manuals.

2000 STATIC TESTING

2010z PRESSURE TESTING PIPEWORK - GENERAL:

Comply with procedures given in BESA Guide to Good Practice for Site Pressure Testing of Pipework. (TR/6) Ensure safety precautions detailed in HSE Guidance Note GS4 Safety in Pressure Testing are adopted.

Isolate components that cannot withstand the test pressures. Isolate these as near to the component as possible.

Provide a blanked connection to accommodate a check gauge in addition to the accurate gauge fitted to section under test.

Test concealed or buried pipework and ductlines before any permanent covering is applied.

Carry out works test for individual items of equipment as detailed in the work sections of this specification

Advise appropriate personnel, in advance, of the time tests may be witnessed.

Agree test pressure and duration for water mains with local water authority.

2012 PRESSURE AND LEAKAGE TESTING - AIR DUCTLINES:

Carry out air pressure and leakage testing on air ductlines in accordance with DW/143, DW/144 or DW/154 as appropriate and as indicated in section Y30.

2015 PRESSURE AND LEAKAGE TESTING - BUILDER'S WORK SHAFTS, VOIDS, ENCLOSURES AND FLOOR VOIDS / PLENUMS:

Ensure all builder's work shafts, voids and enclosures are pressure and leakage tested, and signify acceptance of standard and integrity of construction, prior to pre-commissioning of engineering installations.

Pressure test floor plenums / voids using a specialist building airtightness tester ATTMA registered to level 2 using ATTMA standard TS L2 and BSRIA BG65/2016 – Floor Plenum Air tightness Guidance and Testing Methodology.

Maximum value of plenum air leakage to be 0.7l/s/m2 of floor area at a test pressure of 50Pa or 5% of the air volume flow rate supplied to the plenum.

Maximum raise access floor leakage to be 1.0l/s/m2 of floor area without carpets at a test pressure of 50Pa

2020 PRESSURE TESTING - WATER CIRCULATING AND SUPPLY SYSTEMS AND STEAM AND CONDENSE LINES:

Carry out Hydraulic Pressure Testing as described in BESA Guide to good Practice for Site Pressure Testing of Pipework (TR/6). Test section by section for one hour, as the work proceeds and prior to application of thermal insulation as follows.

Operating gauge pressure less than 3.5 bar, test gauge one and a half times the maximum working pressure.
Operating gauge pressure 3.5 - 7.0 bar, test gauge pressure twice the maximum working pressure.
Operating gauge pressure greater than 7.0 bar, test gauge pressure 14.0 bar or one and a half times the maximum working pressure, whichever is the greater.

Comply with BESA TR/20 part 8 for steam and condensate systems.

2030B PRESSURE TESTING - UNDERGROUND PIPEWORK:

Test to a gauge pressure twice the operating pressure or 7 bar, whichever is the greater, for 4 hours.
Test pre-insulated bonded steel pipe systems for district heating in accordance with BS EN 13941-2
Test pre-insulated non bonded pipe systems in accordance with the system manufacturer's recommendations.
Test pre-insulated bonded flexible pipe systems in accordance with the system manufacturer's recommendations

2042 PRESSURE AND LEAKAGE TESTING - WATER SERVICES INSTALLATIONS:

Inspect and test water services installations in accordance with relevant parts of BS EN 806 and BS 8558 and to the requirements of the Local Water Undertaking.
Ensure the provisions laid down in BESA TR/6 Site Pressure Testing of Pipework for testing underground CWS mains are carried out.

2050 PRESSURE TESTING - FIRE RISERS:

Undertake static pressure tests followed by flow and pressure tests in accordance with BS 9990. Demonstrate to Fire Brigade when tests are satisfactory.
On completion of the static test check operation of the non-return valves integral within the inlet breeching unit by using the static pressure exerted by the full water capacity of the riser.
For Wet Riser pipework undertake static water pressure test to a pressure not less than the system closed valve pressure exerted by the wet riser pump set when designed to operate at the flow and pressure defined in BS 9990. Ensure pressure is maintained for a minimum period of 15minutes.

2055 PRESSURE TESTING - REFRIGERANT PIPEWORK:

Comply with relevant Institute of Refrigeration (IOR) Safety Code of Practice for refrigerant used in the installation and BS EN 378-2.
Test refrigerant pipework using the strength test procedure as detailed in Clause R6.4 of the CIBSE Commissioning Code R: 2002. Test refrigerant pipework using the leak test procedure as detailed in Clause R6.5 of the CIBSE Commissioning Code R: 2002. Test refrigerant pipework using the deep vacuum test method as detailed in Clause R6.6 of the CIBSE Commissioning Code R: 2002

2062 PRESSURE AND LEAKAGE TESTING - GAS PIPEWORK OTHER THAN MEDICAL GASES:

Pressure test and commission gas infrastructure pipework (external to buildings) in accordance with BS EN 12327
Carry out a pneumatic leak test on natural gas pipework followed by a pneumatic pressure test as described in BSEA TR/6 Site pressure testing of pipework.
For Natural gas systems, Purging and soundness testing shall only be carried out by authorised persons in accordance with the Institutions of Gas Engineers Publication IGE/UP/1 "Soundness Testing and Purging of Industrial and Commercial Gas Installations".

Test records shall be kept based on IGE/UP/1 requirements and prepared to provide a record of satisfactory witnessed tests and procedures for soundness testing and purging.

For small low pressure natural gas systems comply with IGE/UP/1A and for domestic natural gas systems comply with IEG/UP1B

For other systems (such as gaseous fire protection systems), carry out a pneumatic leak test followed by a pneumatic pressure test as described in BESA Guide to Good Practice for Site Pressure Testing of Pipework (TR/6). Upon their completion, pressure/leak test the areas to be protected to ensure that their leakage characteristics are as assumed in the specialist's design.

2065 PRESSURE TESTING - OIL PIPEWORK:

Test oil pipework installation in accordance with relevant part of BS 5410 to suit the application and TR/6 Site pressure testing of pipework. BESA. Guide to good practice.

2072 PRESSURE AND LEAKAGE TESTING - PIPED MEDICAL SERVICES:
Test to requirements of Hospital Technical Memorandum 02-01 Part A.

2075 TESTING CONDENSE AND OVERFLOW SYSTEMS:
Test condensate drainage systems from cooling coils and any overflow pipework / drainage pipework from plant in accordance with BS EN 12056-2 and BESA TR/6 Site pressure testing of pipework.

2082 PRESSURE AND LEAKAGE TESTING - SOIL, WASTE, VENTILATION, ANTI-SIPHON AND RAINWATER PIPEWORK:
Test section by section as the work proceeds and subsequently on completion with all sanitary fittings fixed and working.
Submit systems to two separate tests, Air test and Hydraulic Performance test in accordance with BS EN 12056 – 2.
Siphonic rainwater pipework shall be flow and positive pressure tested in accordance with manufacturer's recommendations and BS 8490.

2090 PRESSURE TESTING - UNDERSLAB DRAINAGE:
Test section by section as the work proceeds and subsequently after completion of backfilling and compaction to the satisfaction of the Engineers and the local Authority.
Individually test sections which will be permanently embedded in the structure or concealed in ducts or voids.
Submit sections to two separate tests Water test and Test for Straightness and Obstruction in accordance with BS EN 752 and BS EN 1610.

2100 VACUUM SYSTEM TESTING:
Test medical and laboratory vacuum systems in accordance with HTM 02-01 Part A and the vacuum system manufacturer and / or specialist's recommendations.

2102 TESTING WIRING INSTALLATIONS:
Ensure all electrical installations associated with the system, are tested in accordance with BS 7670 IET Wiring Regulations before any plant is run.

2112 TESTING RECORDS:
Keep a systematic record of tests. Submit samples of test record sheets for agreement prior to testing. Obtain signatures of nominated witnesses to tests. Distribute records as indicated in specification section A33.

3000 COMMISSIONING

3002 COMMISSIONING PROPOSALS
Submit proposals for commissioning as indicated in specification work Section A33 or A64 - General Engineering Technical Items. Use commissioning specialists who are members of The Commissioning Specialist Association (CSA).

3012 CLEANING DUCTWORK SYSTEMS:
Clean ductwork before plant is first run, using access openings in ductwork. Carry out cleanliness checks and procedures listed in CIBSE Commissioning Code Series A Air Distribution and BSRIA Guide BG49/2013 Commissioning Air Systems. Also refer to specification section Y30, clause 4091 and schedule Y30sch1 regarding ductwork internal cleanliness.

3014 CLEANING PIPEWORK SYSTEMS:
Flush and clean all pipework systems before the plant is first run. Carry out flushing procedures listed in CIBSE Commissioning Code W: Water Distribution Systems and BSRIA Guide BG29/2012 Pre-commissioning cleaning of pipework systems and the requirements of specification section Y25.

3020 COMMISSIONING CODES:

Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guides for water systems and air systems to achieve the standards set in the CIBSE Commissioning Codes.

3025 SEASONAL COMMISSIONING (or Commissioning –implementation)

Provide appropriately qualified personnel and all necessary equipment and materials to execute the seasonal commissioning works. The same organisation / team that carried out the original construction works shall undertake the seasonal commissioning.

A schedule of suitable working periods and essential services to be maintained during any work will be provided by the building operator.

A programme for the works shall be provided at least 1 month prior to the start date. This should account for any phased handovers, cause as little disruption as possible and ensure essential services are maintained.

The works shall comply with all statutory and client specific Health and Safety requirements.

Any performance deficiencies found during seasonal commissioning shall be corrected.

All seasonal commissioning shall be carried out in accordance with the project commissioning specification, an approved method statement, manufacturers' guidelines and the day-to day operational requirements of the building users.

Record all seasonal commissioning works and after completion of the works update all building documentation including O&M manuals, Building Manual, Building Log book, Building User Guide and the Building Information Model (BIM). Any changes made to the systems during the works shall be clearly identified.

BREEAM New Construction 2018 requirements

Comply with Issue ID Man 04 Commissioning and Handover.

Comply with Issue ID Man 05 Aftercare.

BREEAM Refurbishment and Fit Out 2014 requirements

Comply with Issue ID Man 04 Commissioning and Handover.

Comply with Issue ID Man 05 Aftercare

3031 COMMISSIONING WATER DISTRIBUTION SYSTEMS:

Preliminary checks

Carry out checks and procedures as detailed in CIBSE Commissioning Code W.

Ensure system is statically complete as defined in BSRIA Guide BG2/2010 Commissioning of water systems in buildings

Use pre-commissioning checklist from BSRIA guide BG2/2010

Setting to work and regulation

Set to work and regulate water distribution systems in accordance with CIBSE Commissioning Code W and BSRIA Guide BG2/2010 Undertake an initial scan of the system and document the results. Follow guidance for commissioning of variable flow water systems in CIBSE KS9 (Commissioning variable flow pipework systems)and BSRIA BG2.

Measurement

Use instruments for measurement generally as detailed in BSRIA Guide BG2/2010

For each belt driven pump provide a change of belts and drives (to be sized after balancing the system). Allow for changing belts and drives and recommissioning pump and then rechecking system as necessary to achieve the specified duty.

For each direct driven pump (both single pumps and twin headed pumps) without inverter or other speed control, allow for a change of impeller (to be sized after balancing the system). Allow for changing impeller and recommissioning pump and then rechecking system as necessary to achieve the specified duty.

Commission district heating pipe systems using thermally insulated bonded single and twin pipe systems in accordance with BS EN 13941-2 Annex E.

Commission district heating / cooling systems in accordance with the manufacturer's recommendation.

3041 COMMISSIONING AIR DISTRIBUTION SYSTEMS:

Preliminary checks

Carry out checks and procedures as detailed in CIBSE Commissioning Code A, Section A1.
Ensure system is statically complete as defined in BSRIA Guide BG49/2015 Commissioning of air systems.
Use pre-commissioning checklist in BSRIA guide BG 49/2015
Verify the fitness for purpose of installed systems before, during and after hand over in accordance with BS EN 12599 as required.

Setting to work and regulation

Set to work and regulate air distribution systems in accordance with CIBSE Commissioning Code A and BSRIA guide BG 49. Undertake an initial scan of the system and document the results.

Measurement of air flow

Use instruments for measurement and methods of measurement detailed in BSRIA Guide BG 49/2015 and CIBSE commissioning code A.

Undertake tests and checks to ventilation and air conditioning systems generally in accordance with BS EN 12599 in order to verify the fitness for purpose of the installed systems before, during and after handover. Method statement to include relevant checklists from BS EN 12599.

Where scheduled, undertake measurements in the occupied zone in air-conditioned / ventilated rooms, including the following: airflow, air velocities, temperatures and sound pressure levels in accordance with BS EN 15726.

For each belt driven fan provide a change of belts and drives (to be sized after balancing the system). Allow for changing belts and drives and recommissioning fan and rechecking system as necessary.
For each direct drive, adjustable pitch, axial fan, allow for a change of pitch angle (to be determined after balancing the system). Allow for recommissioning each system after the fan blade pitch change.

Undertake works and checks generally in accordance with BS EN 12599: *Ventilation for buildings - Test procedures and measurement methods to hand over air conditioning and ventilation systems* - in order to verify the fitness for purpose of the installed systems before, during and after handing over. Method statement to include relevant checklists from BS EN 12599.

3051 COMMISSIONING BOILER PLANT:

Follow the procedures laid down for carrying out Preliminary Checks and Start Operation in accordance with CIBSE Commissioning Code B and manufacturer's instructions.

Apparatus and Instruments

Use Apparatus and Instruments detailed in CIBSE Commissioning Code B, Appendix BA1 Apply tolerances defined in Appendix BA1.

Commission the combustion aspects steam boiler plant in accordance with the principles outlined in CIBSE Commissioning Code B. Follow the procedures in the relevant parts of BS EN 12952 and BS EN 12953 for testing, commissioning and acceptance tests of steam boiler plant.
The boiler manufacturers in accordance with a method statement, which has been approved by the client's insurance inspectors and the CA, must commission steam boiler plant.

3052 COMMISSIONING STEAM SYSTEMS:

Commission steam systems in accordance with:

The boiler manufacturer, specialist steam equipment manufacturers' and water treatment specialist's recommendations
The CSA (Commissioning Specialists Association) Technical Memorandum - TM7

Steam boiler plant

Combustion aspects of steam boiler plant to be commissioned in accordance with the principles outlined in CIBSE Commissioning Code B.
Follow the procedures in the relevant parts of BS EN 12952 and BS EN 12953 for testing, commissioning and acceptance tests of steam boilers and ancillary plant.
The boiler manufacturers must commission steam boiler plant in accordance with a method statement, which has been approved by the client's insurance inspectors and the Contract Administrator.

3055 COMMISSIONING OF GAS PLANT AND SYSTEMS:

Commission gas fired plant on industrial and commercial premises in accordance with IGEM/UP/4.
Commission gas infrastructure (external to buildings) supply systems in accordance with BS EN 12327.
Undertake all completion and commissioning procedures detailed in Section 17 of IGEM/UP/2 edition 3 and provide new gas pipework commissioning checklist based on Appendix 16 in UP/2.
Provide a scheme for inspection, testing and maintenance of the gas installation for inclusion in the O&M manuals to ensure continued integrity.

3061 COMMISSIONING REFRIGERATING SYSTEMS:

Comply with relevant Institute of Refrigeration (IOR) Safety Code of Practice for refrigerant used in the installation and BS EN 378-2.
Commission refrigerating systems in accordance with CIBSE Commissioning code R.

3081 COMMISSIONING PLANT ITEMS AND OTHER SYSTEMS:

Where no CIBSE or BSRIA manuals are published that cover the commissioning of specific plant items or other systems submit detailed proposals and comply with the manufacturers' recommendations for setting to work.

3091 INSTRUMENTS AND GAUGES:

Ensure instruments are correctly calibrated. Record details of instruments on record sheets.

Submit evidence of correct calibration of instruments to be used in connection with commissioning and testing.

3101 AIR SYSTEMS COMMISSIONING RECORDS TO BSRIA GUIDE BG 49/2015:

Keep a systematic record of commissioning results and distribute as indicated.
For air systems.
A record of the initial scan of the system shall form part of the commissioning results. These results shall be included in the Operation and Maintenance manuals.
Use record sheets as detailed in BSRIA Guide BG 49/2015 Commissioning Air systems.

3102 WATER SYSTEMS COMMISSIONING RECORDS TO BSRIA GUIDE BG2/2010:

Keep a systematic record of commissioning results and distribute as indicated.
For water systems
A record of the initial scan of the system shall form part of the commissioning results. These results shall be included in the Operation and Maintenance manuals.
Use record sheets as detailed in BSRIA Guide BG2/2010, Commissioning of water systems.

3110 BMS COMMISSIONING - CONTROL SYSTEM SPECIFICATION DETAILS REQUIRED FOR COMMISSIONING:

Ensure that the following information is supplied to the commissioning engineer:

- A network schematic providing a record of the overall control system architecture.
- Schematics of the systems to be controlled indicating the location of sensors and actuators.
- A written description of the configured control strategies.
- Control strategy logic diagrams in the form of logic flow charts.
- Set-points and other control settings such as initial default parameters for control loops relating to the control strategies.
- Criteria relating to control accuracy and stability.
- A points list including digital inputs/outputs and analogue inputs/outputs.
- Control panel drawings.
- BMS operator workstation graphics and associated point data displaying monitored conditions.
- Trend logging archiving requirements and alarm routing.
- The scope of operational and specified functionality of management software, e.g. utility monitoring and targeting software.
- Functional requirements of any occupant interfaces.
- Details of any hard-wired interfaces from, or to, other control devices.
- Functionality and scope of data to be transferred over any gateway for use as part of an integrated system.
- Functional profiles for any direct interoperability integration.

Ensure that the following is included in the BMS commissioning specification:-

- A clear description of the division of responsibility between the various parties.

Off-site and on-site pre-commissioning procedures.
On-site commissioning procedures.
Requirements for assistance to air and water balancing testing (e.g. opening and closing control valves) and other plant tests where the controls need to be overridden.
A requirement for any point-by-point verification of correct operation.
Requirements for evaluation of control loop performance/loop tuning.
Requirements for the BMS operator workstation for assistance in the commissioning of plant.
Arrangement for the management of delays.
Phased completion requirements.
Requirements for demonstration/witness testing on the basis of a percentage of points or on a point-by-point basis. Ensure that the witnessing requirement includes the identification of those responsible.
Requirement for software/configuration data back-up.
Requirement for, and involvement in, any complete system and sub-system performance testing.
Requirement for system documentation.
Requirement for operator training requirements.
Requirement for post occupancy checks.

3112 COMMISSIONING OF ELECTRICAL INSTALLATIONS:

Refer to specification section Y81

Ensure all electrical installations associated with the system are tested and commissioned before any plant is run.

Carry out electrical checks listed in CIBSE Commissioning documents:-
Series A Air Distribution Systems - A1.5
Code W: Water Distribution Systems

3120 BMS COMMISSIONING – PRE-COMMISSIONING (inc NES clause 3140)

Ensure that the BMS is pre-commissioned to allow the building services plant to operate under "manual" running conditions.
Ensure that the control valves can be manually set in their fully open position to allow the balancing of pipework flows.
Ensure that dampers can be manually opened to allow the commissioning of air systems.

Ensure that as much pre-commissioning work as possible is performed off-site:
Ensure that the following is followed:

Pre-commissioning action	*Pre-commissioning off-site*
Control application software	Yes (final commissioning on-site)
User interface software	Yes (final commissioning on-site)
Control panels	Yes (final commissioning on-site)
Terminal units (fan coil units, etc)	Yes (final commissioning on site)
Wiring	No
Communications network	No
Sensors	No
Actuators	No
Integration gateways	Partial

Ensure that a record of all settings, set-points and offsets are maintained throughout the pre-commissioning period.
Ensure that all final physical adjustments to the field devices are indelibly marked.
Ensure that all packaged plant interfaced with the BMS is fully tested and commissioned by the manufacturer or installer.
Ensure that the BMS is pre-commissioned in accordance with the requirements of CIBSE Code C (Commissioning of automatic control systems).
Ensure that the BMS is pre-commissioned to allow the building services plant to operate under "manual" running conditions.
Ensure that the control valves can be manually set in their fully open position to allow the balancing of pipework flows.
Ensure that dampers can be manually opened to allow the commissioning of air systems.

3130A BMS COMMISSIONING - PLANT READY FOR CONTROL SYSTEM COMMISSIONING

Confirm that the following plant commissioning has been performed before commencing the final BMS commissioning:

Water systems

Ensure the system is cleaned and flushed to remove any debris.

All regulating, isolating and control valves in place and operating correctly.

That all flow measuring devices are in place and in the correct location for accurate measurement (including pressure tappings).

The system is vented.

That the proportional balancing is completed to obtain the branch flow rates in the correct ratio to each other (or through the use of and setting of self-balancing valves).

That the pump flow rate has been adjusted to provide the specified flow rate.

Air systems

Debris has been removed from the air distribution system.

That dampers are in the correct location and fully functional.

That fire/smoke dampers open.

Test holes have been drilled and sealed with removable plugs.

That in-situ flow measuring devices have been installed.

Ductwork aIr leakage testing has been performed (if specified).

Completion of proportional balancing of regulating dampers so that terminals share the air flow in the correct proportions.

Regulation of the fan(s) to provide the specified flow rate.

Packaged equipment

Ensure that plant and controls have been fully commissioned and are functional, ready for integration with other plant/systems.

That control equipment inputs/outputs are in the specified format for connection to the main control system.

Confirm that the plant is commissioned in accordance with:

Air distribution systems, CIBSE Code A

Boiler plant, CIBSE Code B

Refrigeration systems, CIBSE Code R

Water distribution systems, CIBSE Code W

Commissioning of water systems BG2/2010, BSRIA

The commissioning of air systems in buildings, BG49/2015, BSRIA.

3151 COMMISSIONING BMS / AUTOMATIC CONTROL SYSTEMS

Carry out commissioning of Automatic Control Systems in accordance with Manual prepared by the controls equipment manufacturer. Carry out the Checking and Setting-Up procedure detailed in the CIBSE Commissioning Code C, Section C1.

Measurement

Carry out measurements in accordance with CIBSE Commissioning Code C, Appendix C2.1.

Ensure that the BMS is commissioned in accordance with the requirements of CIBSE Code C

Wherever possible load, prove and commission all software off-site.

Carry out all tests necessary to ensure the correct operational state of the installation. Load and prove all software. Set all variable parameters and switches to the appropriate values and settings to ensure compliance with the specification.

Prior to activating any BMS control of plant demonstrate all safety interlocks and ensure all fail safe conditions are implemented and operational.

Record values and settings of all variable parameters and switches set as part of the commissioning process. Include these records in Record Documents.

Indelibly mark all physical adjustments to BMS devices.

3152 BMS WITNESSING REQUIREMENTS: (NES clause A32 151.000 / W60 360.010))

The Contractor shall implement the following CA's witnessing requirements. Ensure that on-site commissioning staff facilitate the witnessing process.

Confirm that the BMS hardware is installed in accordance with Section W60.

Verify any operator software and associated graphics.

Witness completely the control of any main and/or critical items of plant along with a random sample of other points.

If less than 300 points, witness all points. Between 300 and 1,000 points witness 50% (minimum of 300 to be witnessed). If more than 1,000 points witness 20% (with a minimum of 500 points witnessed).

Reserve the right to witness 100% of the points if the failure rate is greater than 5%.

Witness a sample of specific functions, eg 10% of alarms and 10% of data logging.
Witness one of several identical items of plant in detail with the others witnessed on a random basis.
Verify the system security access.
Verify that all safety-related functions perform to that specified, eg plant shutdown on fire condition.
Verify all plant restarts according to that specified after building power failure and local power failure.
Witness all power meter data-points to ensure that they match the meters.
Ensure that trend logs are used when witnessing points in order to monitor the performance of control actions.
Verify the handover of all operating manuals and system documentation.
Verify the handover of backup copies of software.
Verify the completion of any specified system operator training.

3153 BMS - POST HANDOVER CHECKS: (Edited from NES clause A32 152.000 / W60 360.050)

Ensure that the following post-handover checks are performed:
Global level checks
- Internal air temperature.
- Relative humidity.
- Ventilation levels
- Energy consumption (ensure that the pulse-input counters match the meters).
- Requirements associated with seasonal commissioning
- Soft landings requirements

Check that each of the above meets the specified requirements.

System level checks
- Control strategies. Check that any suspect control strategies are appropriate for the intended application. Check that the suspect control strategy has been implemented and commissioned correctly. Check that the control strategy is still appropriate for the intended use.
- Network communications. Check that all relevant field controllers communicate properly. Check for correct sharing between controllers of relevant data and correct inter-controller operation.
- Control set-points. Check that the set-points in question are correct and appropriate for the actual operating conditions.
- Control loop settings. Check that the control loop settings result in accurate and stable control. Check that all self-learnt characteristics are valid.
- Occupant controls. Check that occupant controls work correctly.

Sub-system/component level
- Sensors. Check the accuracy and location of any suspect sensors.
- Actuators. Check that any suspect actuators operate correctly.
- Dampers and valves. Check that there are no dampers and valves that are jammed and that they operate as intended

4000 PERFORMANCE TESTING (NES 251.050)

4010 SYSTEM PERFORMANCE TESTING / DEMONSTRATIONS:

Demonstrate the performance and control sequence, including the operation of all safety devices, of installations including single, standby, multi-duty plants and systems, and of plants specified for future use.

4015z TESTING OF RESIDENTIAL VENTILATION SYSTEMS:

Demonstrate the performance of residential ventilation systems through performance testing and installation checks in accordance with BS EN 14134.
Comply with the best practice requirements of BSRIA BG 46/2015 “Domestic Ventilation Systems – A Guide to Measuring Air Flow Rates””. For measurement of air flow rates use the unconditional method.

4020z PERFORMANCE TESTS, CAPACITY TESTS AND ENVIRONMENTAL TESTING:

Carry out performance and capacity tests and environmental testing for all systems and in all areas of the building to prove and demonstrate the performance of the systems and plant item duties.
Where applicable, on ventilation facilities correct the measured air flow rate when ambient measuring conditions are different from standard conditions in accordance with PD CEN/TS 17153.
Specific Fan Power Validation tests
- After fitting clean filters, air handling systems to be commissioned under validation load. Measure the specific fan power SFP of each system for calculation of the building "as constructed" CO_2 emission rate.

Site performance testing of heating and cooling coils

Where specified in the scope of works or scheduled undertake in accordance with Commissioning Specialists Association guide TM10 – Site performance testing of heating and cooling coils.

For environmental testing, the minimum requirement is to test each room using the BMS (unless stated otherwise in Y51sch2) for at least 48hours during which period the temperature and Humidity (if controlled) set points must be varied at least twice to prove the correct responses of control systems and plant. Temperature / humidity logs shall be provided as a record of the testing.

Apply artificial loads to simulate sensible and latent gains. Use calibrated data loggers or chart recorders (independent of the BMS) in those areas detailed in the scope of works, or where indicated in schedule Y51sch2 or otherwise provide test arrangements to simulate the full range of operating conditions and duties.

Undertake system proving during the defects period by recording, evaluating and reporting on the seasonal performance of the systems against their design values. Ensure that both summer and winter maximum and minimum conditions are covered by the test results.
Carry out ambient air quality tests in accordance with BS EN 13528-1, BS EN 13528-2 and BS EN 13582-3 as scheduled.

Undertake measurements in the occupied zone in air-conditioned / ventilated rooms, including the following: airflow, air velocities, temperatures and sound pressure levels as scheduled or described in the scope of works / commissioning specification in accordance with BS EN 15726.

Carry out measurements of sound or noise levels in all internal and external areas of the building or project to demonstrate that the designed values are being achieved or not exceeded as appropriate.

4024 CONTROLS DEMONSTRATION AND VERIFICATION:

Demonstration and verification that the controls systems are fully operational, commissioned and deliverables have been made shall include, but not be limited to, the following:-

: Demonstration of operation of software prior to installation
: Audit of cabling and hardware installation
: Demonstration of physical and logical integrity of system, including demonstrating that sensors and actuators correctly connected and addressed.
: Demonstration of control actions, including operation of all safety devices
: Demonstration of sensor calibration
: Demonstration of successful system software commissioning, including reloading software and documented commissioning data from media and subsequent satisfactory operation.
: Verification of specified graphics
: Verification of satisfactory training of client's staff
: Verification of the handover of all specified operating manuals, documentation and drawings
: Verification of handover of back-up copies of software
: Verification of handover of consumable spares

4030z RECORDERS:

During performance, capacity and environmental testing provide recorders as necessary to demonstrate the system performance.

Following completion provide and maintain on free loan portable at least three seven day space temperature and relative humidity recorders, together with adequate charts.
Provide other recorders as agreed with the engineer.

4040 OTHER SYSTEMS

4040A RAINWATER SYSTEMS:

Demonstrate by flow tests that the systems give satisfactory performance.

4040B SANITARY SYSTEMS:

Comply with performance tests given in BS EN 12056 – 2.

4040C HOT AND COLD WATER / BOOSTED COLD WATER SYSTEMS:

Demonstrate and record that outlets supply adequate rates of flow.
Demonstrate that the hot water temperature at each outlet to reaches 50°C (55°C in healthcare premises) within one minute of turning on the tap.
In installations where the HWS return is local to the outlet, demonstrate that the hot water temperature at each outlet to reaches 50°C in less than 30seconds

4040D FIRE FIGHTING / SMOKE & HEAT CONTROL SYSTEMS:

Comply with requirements of the local Fire Authority, with the appropriate sections of BS 9999 and BS 9990 and the appropriate systems standards detailed elsewhere in this specification.

Comply with BS 5306-1 for hose reels.

Dry Riser System; undertake flow and pressure test at the highest outlet .of a flow of 25l/s at a running pressure of 4 bar or as agreed with the fire brigade. On each valve outlet below highest outlet undertake full bore flow test to prove no impedance to valve outlet flow

Wet Riser System; Undertake flow and pressure test at each outlet of 25l/s at a running pressure of 8bar. Or as agreed with the fire authority.
Where requested by the engineer carry out proving test of the riser's intermediate isolation valves and pump suction and delivery valves. Where the valves are monitored undertake proving test of the monitoring system by means of closing each valve and witnessing the alarm signal at the central panel location.

Wet riser storage tank infill main where installed undertake flow test utilising inline flow meter.
Carryout proving test on the open and close operation of the storage tank infill float valves and prove operation of the storage tank high water level and low water level tank alarms and witness alarm signal at the alarm panel

On each pump undertake flow and pressure proving test utilising pump back to tank test line

Undertake pump automatic start test by lowering system pressure to below pump start pressure Test to be undertaken to each pump simulating standby pump operation by isolating lead pump and lowering system pressure..
Witness alarm signal of pump starting at alarm panel.

Simulate pump failure to prove pump failed signal on system alarm
On diesel pump set undertake '6 crank test' to simulate diesel pump failed to start signal.

4040E HYDRAULIC SYSTEMS:

Comply with requirements as indicated.

4040F MEDICAL GAS AND AIR SYSTEMS:

Comply with Health Technical Memorandum 02-01 Part A.

4040G LABORATORY AND INDUSTRIAL SYSTEMS:

Comply with requirements as indicated.

4040H GAS SYSTEMS:

Comply with the requirements of the local Authority.

4040I SILENCERS AND PLANT ACOUSTIC TREATMENT:

Demonstrate by measured tests that noise criteria indicated have been achieved.
Sound pressure levels from equipment to be measured in accordance with BS EN ISO 16032.

4040J ACOUSTIC ENCLOSURES:

Demonstrate that measured air leakage complies with scheduled values.

4050z PERFORMANCE TEST RECORDS:

Keep a systematic record of tests. Distribute records as indicated in Section A33.

4062 FINE TUNING:

Carry out fine-tuning as required by the engineer.

10000 NES

Based on NES version Y51 – Dec 19

Y52 – Vibration Isolation Mountings

1010 DESIGN INTENT:

Supply equipment indicated to ensure that vibration from equipment is not transmitted to building, other supporting structure, pipework or ductwork. Consider the potential for structure-borne noise transmission as well as vibration.

1012 SELECTION OF MOUNTINGS

Mountings and inertia bases should be selected to suit the equipment and static deflections scheduled. Number of mounts to be selected by the specialist supplier.

1013 INERTIA BASES

Inertia bases and steel frames are intended to provide a more stable base for plant, provide more uniform weight distribution, reduce the centre of gravity and, if massive enough, reduce the amplitude of vibration.

1020 SPRING ANTI VIBRATION MOUNTINGS:

Select spring mounts with an overload capacity of 50%, for metal springs the outside diameter should be at least 75% of operating height. Permanently identify individual mounts with their load capacity.

1030 SPRING HANGERS:

Provide spring hangers that allow the lower hanger rod to move laterally at least 15°.

1040 LOCKING FACILITY:

Where indicated, provide lockable levelling device.

2000 PRODUCTS/MATERIALS

2011 MAT AND PAD MOUNTINGS:

Provide configured mat mountings with a waffle or ribbed section manufactured from synthetic rubber or neoprene.

or Provide pad mountings manufactured from composite synthetic rubber.

or as otherwise indicated.

Where mats are stacked, bond 1mm steel sheet thickness between each pad and to the top and base without filling voids.

2021 TURRET COMPRESSION MOUNTINGS:

Provide turret compression mountings fabricated from synthetic rubber or neoprene and mild steel.

or as otherwise indicated.

Protect the metal from corrosion by painting and fix friction pads to top and bottom.

Provide bolt holes to allow fixing.

2030 SPRING COMPRESSION MOUNTINGS:

Provide spring compression mountings comprising high strength low stress helical spring capped with steel pressure plate, on resilient base pad, mounted on pre-drilled base for bolting down, and enclosed with cap. Protect metal from corrosion.

2041 CAPTIVE SPRING MOUNTINGS:

Provide captive spring mountings comprising high strength low stress helical spring designed to achieve horizontal and vertical snubbing. Mount spring on resilient base pad predrilled for bolting down and protect against corrosion. Supply complete with a lockable levelling device.

2051 TURRET COMPRESSION HANGERS:

Provide turret compression hangers fabricated from synthetic rubber or neoprene and mild steel.

or as otherwise indicated.

Protect the metal from corrosion by painting and fix friction pads to top and bottom.

Provide bolt holes to allow fixing.

Construct hanger box from steel (minimum thickness 1.6mm) complete with hole for suspension rod and enlarged lower hole for drop rod to equipment.

2061 SPRING COMPRESSION HANGERS:

Provide spring compression hangers comprising high strength low stress helical spring capped with steel pressure plate, on resilient base pad, mounted within hanger box. Construct hanger box from steel (minimum thickness 1.6mm) complete with hole for suspension rod and enlarged lower hole for drop rod to equipment.

Provide spring hangers that allow the lower hanger rod to move laterally at least 15°.

2080 HORIZONTALLY RESTRAINED SPRING MOUNTINGS:

Provide horizontally restrained spring mountings comprising high strength low stress helical spring capped with steel pressure plate, on resilient base pad, mounted within hanger box. Construct hanger box from steel (minimum thickness 1.6mm) complete with holes for installing across connection. In addition supply synthetic rubber or neoprene snubber as a horizontal buffer.

2091 INERTIA BASES - CONCRETE FILLED:

Provide purpose built inertia bases constructed using welded steel frame formwork containing concrete reinforced with 12mm minimum diameter bars at 100mm maximum centres, 35mm above the bottom of the base; and mounted on spring compression mountings.

2092 INERTIA BASES - STEEL FRAMED:

Provide purpose built inertia bases constructed using welded steel frame mounted on spring compression mountings.

2095 MULTIPLE PUMP BASES

Where multiple pumps are fixed to a common base, and they are not to always run at the same time, provide vibration isolation to individual pumps, designed to both avoid the transmission of vibration into the adjacent pumps (in order to avoid "Brinelling" their bearings) and into the pipework to which they are connected.

2101 VIBRATION ISOLATION HOSES:

Provide flexible hose couplings for connecting pipework comprising nylon fabric or steel mesh carcass with waterproof cover and internal lining of material to suit fluid conveyed, temperatures and pressures.

2111 PIPEWORK NOISE ISOLATION:

Incorporate within pipework support ring purpose made isolators manufactured from synthetic rubber or neoprene.
Or provide spring hangers as indicated.

2121 PIPE WALL AND RISER SEALS:

Provide pipe sleeves, minimum length 300mm, with lining of minimum 25mm dense mineral fibre packing sealed with soft setting mastic to both sides unless otherwise indicated.

3000 WORKMANSHIP

3010 GENERAL:

Install vibration isolation equipment and carry out levelling of equipment in accordance with manufacturer's instructions.

3021 CAST IN SITU BASES:

Ensure bases are cast so that in conjunction with the plant load the design static deflection is achieved.

3030 FIXING:

Fix down vibration isolation mountings only where indicated.

3040 HORIZONTALLY RESTRAINED SPRING MOUNTINGS:

Ensure snubbers for limiting excessive movement are installed out of contact during normal operation.

10000 Based on version NES Y52 Dec 19

Y54 – Identification (Mechanical)

1010 REQUIREMENTS:
Identify all pipework, ductwork, equipment, appliances and ancillaries comprising the various systems.

1021 NEW SYSTEMS:
Comprehensively label and colour code throughout the works.
Any systems which have the same colour coding but serve different purposes (eg laboratory / Domestic hot and cold water services) shall have additional descriptive identification.

1030 EXISTING SYSTEMS:
Where identification details are incompatible with those required for new systems, obtain approval to mode of cross referencing.

1041 COLOURS:
To colour ranges given in BS 381C and BS 4800.

1045 PERFORMANCE and DURABILITY:
Ensure durability of all safety signage / identification is in accordance with BS ISO 17398

2000 PRODUCTS/MATERIALS

2011 PIPEWORK IDENTIFICATION:
Standards
Colour code and label to BS 1710.
Identification
Apply primary and secondary identification, to each pipe at least:
Once in every room or enclosed area.
At intervals not exceeding fifteen metres.
At every junction.
At every valve.
At every inspection and access position into service shafts, false ceilings, bulkheads etc.
Primary Identification
Apply colour bands, 300mm wide.
Secondary Identification
Apply colour bands, 50mm wide, and superimpose a legend identifying circuit, direction of fluid or gas flow, nominal pipe bore and, where appropriate, fluid or gas pressure.
Legends
Apply to colour bands by transfers of an approved type.

2021 DUCTWORK IDENTIFICATION:
Standards
Generally colour code and label to BESA Specification DW/144.
Identification
Apply primary and secondary identification, to each duct at least:
Once in every room or enclosed area.
At intervals not exceeding fifteen metres.
At every junction.
At every damper.
At every inspection and access position into service shafts, false ceilings, bulkheads etc.
Primary Identification
Apply colour bands, 300mm wide
Secondary Identification
For ducts with longest side or diameter up to and including 225mm. Paint colour bands 50mm wide and superimpose legends.
For ducts with longest side or diameter over 225mm. Paint or apply transfers to identification triangles, or triangular plates. Superimpose or incorporate legends.
Triangular Plates
Attach to buckle bands or stool pieces and fix to ducting, with apex indicating direction of airflow. Submit details of plates and fixings for approval before painting and marking. Use equilateral triangle of side 150mm minimum.

Legends

Apply transfers of an approved type to colour bands or triangles or triangular plates. Identify floor and space served, associated equipment reference and direction of airflow.

2030z PLANT AND EQUIPMENT IDENTIFICATION, LAMINATED PLATES:

Standards

Identify each item of equipment by name and, where appropriate, by agreed reference characters. Provide colour identification as called for in work sections and, in all cases, colour firefighting equipment red.

Plates

Use rectangular metal or laminated plastic, securely fixed to each item of equipment.

Lettering

Laminated plates, multi-coloured with outer layer removed for lettering. General labels to be white with black lettering.

Legends

Engrave plates with an approved text. Incorporate operating duty of equipment where this is not incorporated in other labelling.

2035 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:

Graphical symbols for use on equipment to be created and applied in accordance with BS EN 80416-1, BS EN 80416-2, BS EN 80416-3.

2040z VALVES COCKS AND OTHER PIPELINE ANCILLARIES IDENTIFICATION:

Standards

Identify each valve, cock, stop valve, air vent, drain cock etc. with disk engraved with numerical reference and service. Except where exposed in occupied areas.

Discs

Securely attach metal or laminated plastic discs, minimum diameter 35mm, to each item. Discs to be white with black lettering.

Legends

Engrave discs with permanent characters, minimum height 6mm.

Incorporate in operating instructions relating to regulating valves and flow measuring Equipment, details of flow rate, pressure differential and setting.

2050z MEDICAL GAS TERMINAL UNITS:

Label and colour code to HTM 02-01, Part A.

Label and colour code small medical gas cylinders to BS EN ISO 407.

2060z LABORATORY OUTLETS:

Colour code and label pipelines and services to BS 1710.

Colour code and label taps and valves for use in laboratories to BS EN 13792.

2070 AIR VOLUME REGULATING AND CONTROL DAMPER IDENTIFICATION:

Standards

Identify each regulating and control damper except where exposed in occupied areas.

On ductwork dampers, clearly indicate commissioning set point.

Identification colours

Use primary and secondary identification colours of associated system for painted or self colour disks.

Discs

Securely attach metal or laminated plastic discs, minimum diameter 35mm, to each item.

Legends

Engrave disks with permanent characters, minimum height 6mm.

2080 INSTRUMENT IDENTIFICATION:

Standards

Identify each instrument by name and, where appropriate, by agreed reference characters.

Plates

Use rectangular metal or laminated plastic, securely fixed to each instrument.

Legends

Engrave plates with an approved text.

2091 DANGER AND WARNING NOTICES:

Hazardous Systems

Colour code and label hazardous systems and equipment to requirements of Health and Safety Executive Guidance Notes.

On natural gas systems, provide identification and warning notices and labels (including a notice adjacent to each main and emergency shut off valve) to meet the requirements of the Gas Safety (Installation and use) Regulations 1998 as amended / ACOP L56 (2018), and Institution of Gas Engineers and Managers (IGEM) requirements.

2105 SYSTEM IDENTIFICATION INSTALLATION CHARTS:

System Schematics

Supply and fix a referenced schematic diagram (or diagrams) of all systems as installed, including equipment and ancillary schedules. Show scheduled information on diagram.

Identify all items by appropriate reference characters.

Control Schematics

Supply for incorporation in O&M manuals a referenced schematic diagram (or diagrams) of all control systems as installed, including equipment and ancillary schedules. Show scheduled information on diagram. Identify all items by appropriate reference characters.

Location

Fix in each plant room or equipment room.

Finish

Plastic encapsulated chart.

10000 Based on NES Y54 text Dec 19

Y60 – Conduit & Cable Trunking

1010 STANDARDS / GENERAL:

Provide conduit and cable trunking in accordance with the relevant British Standards and in particular the requirements of BS 7671 Requirements for Electrical Installations (The IET Wiring Regulations).
Any conduit or trunking must support the function of the cabling system and provide protection, adequate separation distance and presentation as required by the cabling and EMC design.

1012 TRUNKING LAYOUT

Set out cable trunking as indicated on the drawings, making due allowance for any diagrammatic presentation. Provide all necessary offsets, bends, tapers, transformation pieces etc. required as trunking manufacturers standard accessories whether or not these are detailed.

2000 PRODUCTS/MATERIALS

2011 CONDUITS:

Use surface conduit or conduit concealed in building finishes as described in the Work Sections, Schedules or shown on the drawings. Minimum size of conduit shall be 20mm unless otherwise indicated.
Comply with relevant parts of BS EN 61386 including parts 1, 21, 22, and 23 as appropriate.
Buried conduit systems to BS EN 61386-24.
Use conduit from one manufacturer throughout. Use fittings to match conduit grade and finish.
For metal conduit use solid couplers to join lengths of conduit up to 25mm diameter, use oblong 'draw in' boxes to join lengths of conduit of 32mm, 1 1/2" and 2" diameter.
Electrical characteristics for metal conduit shall be electrical continuous.
For plastic conduit do not use slip joints, use expansion couplings where required.
Electrical characteristics for non-metallic conduit shall be electrical insulating.
Temperature classification of conduits shall be -5°+60°C
Conduits shall be non-flame propagating.
Resistance against ingress of water and solid foreign bodies shall be rated to BS EN 60529. minimum IP 31 for indoor use, IP65 for exterior.

2051 CONDUIT FITTINGS AND ADAPTABLE BOXES-METALLIC

For metal conduit use malleable iron conduit fittings, for external areas use malleable iron adaptable boxes and for internal areas use steel adaptable boxes.
Do not use factory made bends, inspection bends or inspection couplers except with 32 mm, 1½" and 2" conduits. Ensure fittings are same class and finish as associated conduit system. Supply covers for circular or adaptable boxes in the same material and finish as boxes. Use steel dome or cheese headed screws to secure covers for Class 2 finish. Use brass dome or cheese headed screws to secure covers with rubber gaskets for Class 4 finish. Limit number of entry holes within loop-in boxes to four.

The minimum size of an adaptable box shall be 100 mm x 100 mm x 50 mm.

Connections use couplers and externally screwed brass bushes to connect conduit to loop-in circular conduit boxes, switchgear, distribution boards, and adaptable boxes. Use flanged couplers with washers.

2061 CONDUIT FITTINGS AND ADAPTABLE BOXES - INSULATING :

Do not use factory made bends, inspection bends or inspection couplers. Use boxes and connections to suit size of conduit and method of jointing. Use heavy gauge, high impact rigid PVC conduit fittings.

Provide all boxes for supporting luminaires or other heavy devices with metal brackets or insert clips to provide a support independent of the box. Provide boxes for flexible conduit, accessories and luminaire connection with a brass earthing terminal and/or steel circular earthing ring.

2080 CABLE TRUNKING AND FITTINGS:

Comply with relevant parts of BS EN 50085. Use trunking of each type from one manufacturer.

2091 METAL SURFACE TRUNKING:

Type / finish – as scheduled
Steel Trunking - Comply with relevant parts of BS EN 50085
Extruded aluminium - Comply with relevant parts of BS EN 50085

Supply partitions and covers same material as trunking. Use trunking manufactured with inward return edge flanges and fitted with flange couplers which ensure that when the cover is removed a minimum of 80% of the nominal trunking or compartment width is available for access.

Resistance against ingress of water and solid foreign bodies shall be rating IP31 to BS EN 60529 for internal use.

Colour to be Manufacturers standard or to BS 4800 standard as scheduled.

Electroplated zinc having a minimum thickness of zinc coating of 0.0012mm inside and outside with additional coating of stoved or air drying paint, applied at least to the external surface.
Hot dip zinc coated steel to BS EN BS EN 10346 or BS EN 10143.

Fixings

Use purpose made brackets to fix to structural steel or suspension rods. Provide external fixing lugs where specified protection for the installation is IP44 or greater.

Fittings

Use bends, tees and angles of similar gauge, type and finish as trunking body and supplied by same manufacturer. Use standard fittings where possible. Where site fabricated fittings are necessary ensure they are comparable in construction and finish with system. Obtain prior approval in writing before site fabricating any fittings or special accessories.

Partitions and Covers

Ensure partitions are electrically continuous with the body of the trunking or provide a connector for a circuit protective conductor. Ensure gap between partitions and lids maintains segregation of circuits.

Joints

Use purpose made jointing pieces fixed with screws into captive nuts. Ensure screws do not protrude through the nuts. Ensure rigidity of trunking is maintained across joint. Ensure external dimensions of trunking are maintained and not reduced by more than 4% across joints between trunking lengths and/or fittings. Use purpose made fittings of the same manufacture where trunking connects to switchgear and distribution boards.

Provide flanges for connection of flush floor trunking to vertical trunking to maintain the cross sectional area of compartments with 50 mm minimum radius.

Maintain electrical continuity at each joint by a copper link, (tinned copper for galvanized trunking), fixed on outside of trunking, secured by screws, nuts and shake proof washers. Screws must not project through the nut. Make provision for continuity to be achieved without need to remove paint from ferrous metal where trunking has a painted finish.

Screws, Nuts, Washers

Do not use self-tapping screws. Use cheese or round head screws except where provision is made for the use of counter-sunk heads. Screws, nuts and washers to be made of brass or steel zinc coated to BS 7371-3 or BS 7371-6

Cable supports

Provide horizontal trunking with removable cable retainers or bridges to retain cables in situ. Provide vertical trunking with pin racks to support cables at 3000 mm maximum spacing. Use insulated pins or insulation sleeved pins on pin racks.

Lighting Trunking Cover

Provide cover strip to prevent ingress of foreign materials, locate cabling in place and act as closure strips between luminaires. Use trunking cover strip clipped into place in trunking body. The Cover strip is to match lighting trunking body or high quality colourfast extruded plastic as scheduled. Colour and shade to BS 4800 as indicated.

2101 FLUSH FLOOR STEEL TRUNKING:

Trunking material -sheet steel trunking to relevant parts of BS EN 50085. Degree of Protection Class 3. Provide flanges for connection of vertical trunking and temporary blanking plates.

Flushfloor cable trunking shall be manufactured from zinc coated sheet steel and shall comprise of a 1.5 mm minimum thickness body section with 3 mm double thickness walls and 3 mm lid section for ‘standard duty lids and 5mm for heavy duty lids.

The trunking body walls shall be provided with a return flange to facilitate fixings and key the trunking into the screed. The compartment separators shall support to the lid and shall be provided with a PVC edging strip, which together with a hard rubber gasket on return edges shall eliminate drumming effect.

All bends, tees intersections and other accessories shall be factory manufactured and finished by the trunking manufacturer. Accessories shall be of a similar construction and finish to the main trunking.

All trunking sections and accessories shall form modules or whole multiples of modules of a size specified, except where special units are required to suit installation requirements. Lid shall be provided in one module lengths and fixed by 4 number countersunk head screws. Where specified, screw collars (of a finish to match to exposed edges of the trunkings) shall be provided to ensure that the fixings screws are flush with the applied floor finish.

At each module position within the trunking body, a brass earth terminal shall be provided within the power compartment.

All trunking bends, tees, intersections, service outlets and telephone distribution boxes shall be provided with recessed lids (to accept the specified floor finish). Where external carpet flanges are specified, they shall be adjustable.

2102 UNDERFLOOR STEEL TRUNKING

Trunking material Sheet steel trunking to BS 4678- 2, gauge of metal - relevant parts of BS EN 50085.

Degree of Protection Class 3.

Provide flanges for connection of vertical trunking and temporary blanking plates.

Unless specified otherwise, trunking shall be manufactured from 1.5mm minimum thickness body sections with 3mm double thickness walls and 3mm lid section.

The trunking body shall be provided with a return flange to facilitate fixings and 'key' the trunking into the screed.

All bends, tees, intersection and other accessories shall be factory manufactured and finished by the trunking manufacturer. All bends shall be of the accessible type unless specified otherwise. Accessories shall be of a similar construction and finish to the main trunking.

Trunking joints shall be provided with a saddle type coupler to prevent the ingress of screed, which shall screw fix to the base flange each side of the joint.

All bends, tees, intersections and service outlet boxes shall be of the dimensions and type specified, the depth of the box shall suit the minimum screed depth. The boxes shall be provided with an adjustable frame and recessed lid (suitable to accept floor finish). Lids shall be manufactured from 1.5 mm minimum gauge zinc coated steel and comprise of a pan plate forming the recess for the finish with a welded re-enforcing plate. Lids at service outlet boxes shall be hinged and lids at bends, tees and intersections shall be screw fixed with screws located in the corners of lids. At trunking connections a 'spout' coupler shall be provided which shall screw fix to the trunking body.

Boxes and frames / lids shall be supplied separately and all boxes shall be fitted with a blank plate to prevent ingress of screed during installation.

Rising bends shall be provided with an 50mm internal radius or gusset.

2103 SKIRTING AND DADO TRUNKING (STEEL)

Skirting and dado trunking body shall be manufactured from 1.2mm (minimum gauge) hot dipped galvanised sheet steel and covers from 1.2mm electrozinc coated sheet steel.

All bends, tees, inter sections and other accessories shall be factory manufactured and finished by the trunking manufacturer. Accessories shall be of a similar construction and finish to the main skirting trunking body / cover.

Joint cover strips shall be provided to secure cover section to the main body and prevent the ingress of dust and moisture.

All special non-standard bends, tees, inter sections and other accessories shall be factory manufactured. No site-manufactured accessories shall be permitted unless otherwise approved by the Engineers.

Outlet plates shall be supplied separately and all accessories plates shall be fitted with a blank plate to prevent ingress of dust and moisture.

Standard- relevant parts of BS EN 50085.

2111 SERVICE OUTLET BOXES:

Provide service outlet boxes and junction boxes constructed from sheet steel with same finish as trunking. Maintain continuity and segregation of compartments through boxes and fit flyovers where necessary. Provide service outlet boxes with separate and segregated access to outlets associated with each wiring compartment. Fit cable guard or grommet to each section. Incorporate spigots or adaptors on boxes for connection to trunking or conduit as appropriate. Make frames adjustable on each corner, recess lids as indicated. Manufacture frame and lids for service outlet boxes and junction boxes and suitable to accept type of floor covering specified.

Provide outlet plates for each low voltage compartment equipped as indicated on the drawings. Provide outlet plates for each information technology compartment that ensures the IT compartment and its outlet plate conform to the requirements of relevant parts of BS EN 50174 and of the IT system installer.
Provide blank outlet plates for any unused compartments.

2121 SERVICE POWER POLES:

Provide service poles and associated conduit or trunking fittings as shown on the drawings. Maintain continuity and segregation of circuits throughout. Provide outlet boxes with separate access to wiring compartments.

Standard	- BS EN 50085-2-4.
Material	- extruded Aluminium
Finish	- Manufacturer's standard
Style	- As scheduled or indicated on the drawings.
Fixings	- Free standing or complete with fixing brackets at top as indicated.
Accessories	- As scheduled or indicated on the drawings.

2131 SURFACE TRUNKING OF INSULATING MATERIALS:

Trunking to relevant parts of BS EN 50085. Material as indicated.
Material – as scheduled or described in scope of works or on drawings
Mechanical properties - trunking for medium mechanical stress.
Minimum storage and transportation temperature, minimum installation and application temperature and maximum application temperature - BS EN 50085-1, Tables 1-3
Electrical characteristics shall be electrical insulating.
Resistance to ingress of water and solid objects shall be minimum rating IP31 to BS EN 60529 for internal use.
Resistance against corrosive or polluting substances - medium protection.
Trunking shall be Non flame propagating.
Fittings

Use fittings from same manufacturer of trunking.
Use `snap-on' covers.
Use trunking fittings and accessories suitable for jointing by solvent welding.
Use proprietary cable retaining clips at 500 mm maximum intervals on trunking that exceeds 1.8 m in length. Where junctions occur ensure first clip is not more than 300 mm from junctions.

2141 UNDERFLOOR TRUNKING OF INSULATING MATERIALS:
Material Heavy gauge, PVC trunking to relevant parts of BS EN 50085.
Minimum storage and transportation temperature, minimum installation and application temperature and maximum application temperature - BS EN 50085-1, Tables 1-3

2151 SEPARATE OR MULTI-COMPARTMENT TRUNKING:
Use separate trunking or multi-compartment trunking for segregation of services. Ensure steel partitions have a provision for connecting a circuit protective conductor.

Provide separation of wiring as required by BS 7671 and the following:
low voltage circuits.
extra low voltage circuits.
communications/data.
emergency lighting.
fire alarm circuits.
incoming telephone circuits supplied by others.

2171 SUPPORTS AND FIXINGS:
Provide proprietary suspension systems comprising channel sections with return lips and compatible fixing accessories of materials to BS EN 10162 or BS EN 10210 and/or slotted angles to BS 4345.
Ensure support components for Class 4 conduit have the same finish method as the conduit carried out after manufacture. Ensure components in direct contact with conduit match profile of conduit.

Ensure all steel components such as studding, bolts and steel screws, bolts, nuts and washers are either cadmium plated and passivated or zinc electroplated to BS 7371 after manufacture. Do not use metal fixing components likely to deteriorate and/or cause damage through electrolytic action.

2176 WIRE ROPE SUSPENSION SYSTEM:
Where specified within the Scope of Works or Schedules, use proprietary Wire Rope Suspensions Systems which comply with BS EN 12385-1, BS EN 13411-3, BS EN 13411-4, DIN 3093, and BSRIA COP 22/2002. Wire Rope Suspensions to be suitable for the safe working load and comprise Stainless Steel grade 316 wire rope, Stainless steel grade 302 Spring fasters with fixings by loops, stud (permanently fixed to wire rope length) or toggle as appropriate. The installation shall comply with BSRIA COP 22/2002 and ‘solid’ stud type suspensions shall be provided at maximum spacing of 20m, with a minimum of one in any straight run.

3000 WORKMANSHIP

3011 GENERAL:
Ensure entire system is electrically and/or mechanically continuous, to BS 7671.

Fire barriers
Comply with the requirements of BS 7671 wherever the conduit or trunking passes through the perimeter of a fire compartment (wall, floor or ceiling).
Install all fire stopping systems in accordance with the manufacturer's written instructions.
Install and inspect fire stopping systems in accordance with Building Regulations and ASFP Code of Practice TGD 17.

Appearance
Arrange conduit, trunking and ducting to present neat appearance, parallel with other service runs and lines of building construction, except where in screed or in-situ concrete. Ensure plumb vertical runs.

Cable installation

Install cable in conduit, trunking or equipment enclosures only when completely erected throughout its length.
Do not use framework of partitions or similar unless indicated.

Building expansion and settlement
Make provision in conduit and trunking at expansion and settlement joints to allow for movement of building structure. Provide circular through or adaptable boxes no more than 300 mm either side of expansion or settlement joints for conduit crossing. Join boxes with flexible steel conduit.

Quality
Cut conduit clean and square with axis. Remove any burrs prior to erection. Site form 90o in conduit wherever practical or use circular or adaptable boxes. Construct bends and sets cold with a bending machine. Do not apply heat when forming sets or bends. Use bending tools complying with British Standards appropriate to conduit material. Ensure no indentation or reduction in cross sectional area occurs during installation. Use correct tools to assemble conduit. Ensure no tool marks or damage to components occurs.

3021 LAYOUT:
Ensure the maximum circuit lengths and groupings of cables indicated are not exceeded.
Where dimensions are not indicated select trunking and conduit sizes in accordance with manufacturer's recommendations, BS 7671 (IET Wiring Regulations), and latest edition of Guidance Note 1 Selection and Erection published by the IET.

3031 SPACING:
Install conduit, trunking and equipment clear of other services. Measure distance from external surface of any thermal insulation. Notify instances where minimum clearance cannot be achieved and bond items concerned.
Minimum general spacings between conduits, trunking and equipment and
insulated steam services - 300 mm.
other services excluding steam - 150 mm.
above central heating radiators - 1000 mm.
Ensure separation is in accordance with manufacturer's recommendations, BS 7671 (IET Wiring Regulations), latest edition of Guidance Note 1 Selection and Erection published by the IET and relevant parts of BS EN 50174 for InformationTechnology cabling installation.

3040 CONDENSATION PREVENTION:
Install conduit and trunking systems to ensure internal condensation does not affect operation of associated circuits. Provide drainage points in accordance with BS 7671.
Where conduit passes through external wall between two areas of different ambient temperatures or in other locations likely to cause condensation, install a conduit or adaptable box. After wiring fill box with inert, permanently plastic compound with high insulation value.

3051 PROTECTION AND REPAIR OF STEEL COMPONENTS:
Paint joints of conduit and minor damages to finish of conduit and trunking, including metal support systems, immediately after erection or after damage occurs.
Use paint compatible with finish as follows:-
For galvanised finish, use two coats zinc rich paint.
For black enamelled finish, use two coats of good quality, air drying, black enamel paint.
Remove grease, oil, dirt and rust before applying protective paint.
Notify serious damage and repair or replace as instructed.

3060 EQUIPMENT CONNECTIONS:
Where surface mounted equipment is installed in conjunction with concealed conduit work, terminate concealed conduit at flush mounted conduit or adaptable box. Drill back of equipment, bush for back entry and mount equipment to conceal back box.
Connect to fixed equipment via conduit box located adjacent to termination point, using either solid or flexible conduit as indicated for final connection to equipment terminations.
Use conduit box as cable change point to facilitate changed wiring locally to adjacent equipment.

Connect trunking to equipment by specially fabricated connectors or by couplers and externally screwed brass bushes.

3070 CLEANING BEFORE WIRING:
Clean inside of conduits and trunking with swabs immediately before wiring.

Inspect all components and remove any foreign matter, fit temporary plugs to open ends of conduit and trunking to prevent ingress of water and solid material.

3081 WIRING:
Comply with BS 7671 when wiring installations. Segregate circuits as indicated.
Ensure draw wires are left within empty conduits for use of specialist installers. Use draw wires comprising galvanized soft iron wires or nylon tapes with fitted eyelets.

For concealed conduit ensure system is installed to enable re-wiring to be carried out from boxes for fittings or accessories only. Draw-in boxes will only be permitted with prior permission in writing.
Do not use tallow or any other substances to facilitate drawing-in of cables.

3090 BUILDERSWORK:
Ensure conduit is not concealed until work has been inspected and approved.
Obtain permission before horizontally chasing walls.
Ensure that conduit and fittings buried in concrete or behind plaster are protected against corrosion or electrolytic action prior to rendering.
Ensure conduit concealed in wall chases is covered by plaster and/or rendering to minimum depth of 12 mm.

4000 WORKMANSHIP FOR CONDUIT

4010 DRAW-IN BOXES:
Provide draw-in boxes in conduit at maximum intervals of 10 metres or after bends and/or sets totalling 180 degrees.

4020 INSTALLATION OF CAST IN OR BURIED CONDUIT:
Ensure cast-in conduits are firmly secured to reinforcing steelwork and that accessory and/or conduit boxes are secured so they do not move during subsequent building operations.

Ensure there is no blockage immediately shuttering is removed. Check there is no mechanical damage to conduit in floor screed prior to screeding. Fix securely before screed is poured. Provide temporary protection to conduits until screeds are laid. Ensure minimum amount of cross-overs occur dependent upon screed depth. Do not install draw boxes in floors.

Do not install conduits in screeds in areas indicated, within site blinding or in main structural slabs unless prior permission in writing is obtained.

4030 CONDUIT BOXES:
Ensure that wherever conduit boxes are cast in, the face of the box is flush with the face of the concrete or plaster. Fit circular conduit boxes with extension rings to ensure a flush face with plaster or concrete or where terminal blocks are to be accommodated.

Ensure fixing holes are countersunk where material thickness allows or use round head screws to prevent damage to cables and remove burrs before cables are drawn in. Use a minimum of two screw fixing for standard circular conduit boxes and four screws for large conduit boxes and adaptable boxes up to 150 mm x 100 mm. Use back outlet boxes where surface conduits pass through walls, to outside accessories or lighting points.

Secure switch boxes and socket boxes using countersunk steel screws where provision is made for them or if not use round head screws, along with plug inserts. Recessed boxes shall be finally grout in position prior to plastering or screeding.

4040 FIXING CONDUIT:

Support conduit in accordance with manufacturer's recommendations, BS 7671 (IET Wiring Regulations), and latest edition of Guidance Note 1 Selection and Erection published by the IET. . Ensure conduit is not under mechanical stress. Fix conduit boxes independently of conduit. Make allowance for any additional mechanical loading supported by conduit boxes. Where protection is specified as IP44 or greater ensure fixings of conduit boxes are suitable to maintain degree of protection.

Use following methods of fixing conduit:-

LOCATION	TYPE OF FIXING
Floor screeds	Saddles or crampets
Buried in plaster or render	Saddles or crampets
Above false ceilings	Saddles
Surface	Saddles

4050 FLEXIBLE AND PLIABLE CONDUIT:

Use flexible conduit for final connections to motors, other equipment subject to vibration or adjustment and to thermostats, motorised valves and similar items mounted in pipelines or ducts. Use sufficient length between equipment and circular through box at end of conduit run (minimum 450 mm) to allow necessary full range of withdrawal, adjustment or movement.

Use solid type adapters to terminate flexible conduit. Use PVC covered flexible conduit where installed externally, exposed to weather or in any position where ingress of moisture or condensation may occur.

4060 SCREWED STEEL CONDUIT:

Use materials clean and free from defects, rust, scale and oil. Obtain prior permission in writing for use of materials subject to remedial work before erection. Repair any damage caused by threading, bending or erection by painting with zinc rich paint before any rust occurs.

Ensure length of thread on conduit matches that in conduit couplers, fittings or equipment with no thread exposed after erection except at running couplers. Ensure conduits butt inside couplers. Use lubricant when cutting threads.

Use minimum number of running couplings
For running couplings in Class 2 conduit, use coupler and locknut. Paint exposed thread with zinc rich paint.
For running couplings in Class 4 conduit, use three piece conduit unions.

4070 NON-METALLIC CONDUIT:

Comply with manufacturer's instructions for bending, setting and jointing of conduit.
Use plastic conduit only where indicated. Do not install conduit when ambient working temperature is or will be below -5°C or above 60°C.
Use solvents recommended by manufacturer of conduit when using solvent welded joints and ensure spigots enter full depth of sockets. Hold joints rigid and in position until weld sets. Remove excess solvent before surface damage occurs.
Use slip joints as necessary, but not exceeding 6 metres on straight lengths to allow for expansion and contraction over temperature variation as indicated. Use semi-mastic adhesive where expansion joints are formed.
Where fitments do not have shaped or smooth conduit entries connect with male bushes and external couplings. Ensure special care is taken to prevent mechanical damage or warping to conduit where mechanical loads are imposed on conduit system, e.g. lighting fittings.

4080 UNDERGROUND INSTALLATION:

Where buried below ground, use Class 4 conduit. Do not use any buried conduit boxes unless prior permission in writing has been obtained. Wrap conduit with PVC self-adhesive tape, half lapped. Extend taping 150 mm beyond point where conduit leaves ground.

Install circular through conduit boxes at the end of the tape. Fill conduit boxes after cable installation with inert, permanently plastic compound with high insulation value, and wrap in PVC self-adhesive tape.

5000 WORKMANSHIP FOR TRUNKING

5010 MANUFACTURE OF TRUNKING:

Take measurements on site before producing drawings for manufacture of trunking.

5020 ACCESS:

Arrange trunking to allow access to wiring. Locate covers on top or sides of trunking if practicable. Arrange access so covers are on a continuous face and cables can be laid in throughout the length of the trunking. Notify where either condition cannot be achieved.

5031 FIXING TRUNKING:

Ensure trunking is independently fixed and supported from building fabric. Obtain approval for proposed fixings/supports.

Support trunking in accordance with manufacturer's recommendations, BS 7671 (IET Wiring Regulations), and latest edition of Guidance Note 1 Selection and Erection published by the IET. Use two fixings minimum at intervals, not exceeding 800mm or 225 mm from accessories, which shall be independently fixed.

5041 STEEL TRUNKING:

Install steel trunking in accordance with the manufacturers requirements and those of BS 7671. Use trunking to avoid multiple parallel conduit runs, subject to approval.

Cut trunking clean and square with axis, prepare ends and remove burrs and sharp edges. Ensure inside of trunking is free from anything liable to damage cables either during installation or after covers are fitted. When trunking is held in a vice, ensure surfaces remain undamaged and components are not warped. Avoid tool marking or damage to trunking system components.

Use folding bars when bending trunking fabric to site form junctions and angles. Ensure corners are neat and metal on either side of corners is not distorted. Do not form flanges by cutting or bending trunking material.

Form circular holes over 6 mm diameter in trunking body using correctly sized punch sets. Use twist drill for holes up to 6 mm maximum diameter.

Use only factory formed openings for accessories. Line unprotected apertures in trunking with PVC or nylon edging strip. Fit ends of runs with removable blanking plates.

Ensure connections are not made to covers unless indicated or approval obtained. Provide fixed section of cover projecting 25 mm either side of fabric where trunking passes through wall, floors or ceiling.

Fit cable retaining straps at 500 mm intervals except where cover is on top.

5051 UNDERFLOOR AND FLUSH FLOOR TRUNKING INSTALLATION:

Trunking shall be cut to length by the manufacturer where possible, however, site cutting by the Electrical Trade Contractor may be necessary to suit site installation conditions (using a bench mounted saw / disc, to ensure a square cut). Trunking lengths and accessories shall be provided complete with coupling pieces and aluminium earth links.

Lay underfloor and flush floor trunking straight and level, flush floor trunkings shall be laid on a levelling screed. Adjust height of services outlets, junction boxes and flush floor trunking to suit top of screed level. Ensure that spaces below trunking are free from voids and correctly packed. Prevent ingress of screed by masking where necessary.

Ensure trunking levelling and alignment is carried out in co-operation with person(s) responsible for confirming location and finish of floor levels.

Immediately following installation of trunking fit temporary covers to service outlets, junction boxes and flush floor trunking, joints between lids, and lids and body shall be sealed by an approved tape. Fit temporary blanking plates over open connections to vertical trunking. Retain temporary covers until permanent covers are installed.

At trunking ends a suitable end cap shall be provided.

Trunkings shall be thoroughly cleaned of steel and brass particles and swabbed through prior to the installation of cables.

Ensure underfloor trunking systems are fully rewirable to final circuit outlets.

Connect conduits only at inspection or other easy access points.

5052 SKIRTING AND DADO TRUNKING

Skirting trunking shall be cut to length by the manufacturer where possible, however site cutting by the Electrical Sub Contractor may be necessary to suit site installation conditions conditions (using a bench

mounted saw / disc, to ensure a square cut).. Trunking lengths and accessories shall be provided completed with coupling pieces and tinned copper earth links.
The trunking body shall be placed direct onto the wall and fixed into place with roundhead screws at top and bottom at regular intervals not exceeding 800mm or 225mm from accessories which shall be independently fixed.
Prior to wall and floor finishes outlet plates shall be fitted with blanking plates. On completion of the finishes the blank plates shall be removed and the accessories (i.e. socket) fitted.
At trunking ends a suitable end cap shall be provided.
The trunking shall be thoroughly cleaned of steel and brass particles and swabbed through prior to the installation of cables.

5060 TRUNKING OF INSULATING MATERIAL:

Comply with manufacturer's instructions. Do not install trunking where ambient temperature is below -5ºC or working temperature is above 60ºC.
Use solvents recommended by trunking manufacturer when making solvent welded joints. Remove excess solvent before surface damage occurs. Hold joints rigid and in position until welds set.
Use manufacturer's standard radiused bends, connector tees, off-sets, end plates and component parts of trunking system assembly.
Ensure no type of trunking other than that specified is installed without approval.
Trunking may be substituted for conduit at certain positions subject to approval.

10000 NES Y60 TEXT Dec 19

1011 CABLE MANUFACTURER / CABLES CERTIFICATION:

Use new cables, delivered to site with seals intact, manufactured not more than one year prior to delivery, labelled with manufacturer's name, size, description, BS number, classification, fire classification to BS EN 50575 and BS EN 13501-6, length, grade and date of manufacture.

Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations) and BS 6701. (Applicable to all 2000 series Products /Materials clauses)

For power and auxiliary cables, and other cables outside the scope of BS 6701

Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule

Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule.

Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass $D_{ca\text{-}s2}$, or the relevant part of BS EN 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule.

For telecommunications, information technology, communications and similar cables

Ensure all cables within the scope of BS 6701 and BS EN 50575 meet BS EN 13501-6 EuroClass E_{ca}, or the requirements of BS EN 60332-1-2, except for cables intended for installation into pathways that are hidden below floors, behind walls, or to which access is limited, which are to meet at least BS EN 13501-6 EuroClass C_{ca}-s1b,d2,a2.

All power cables shall have an independent CENELEC cable certification by the designated body for the country of manufacture to confirm their compliance with Harmonised Standards, British Approvals Service for Electric Cables (BASEC) is the preferred designated body, alternatively fire rated cables may be certified by the LPCB.

1020 CABLE CERTIFICATION MARKING:

Mark all types of power cable with CENELEC cable certification marking or if included in British Approvals Service for Cables (BASEC) in accordance with BASEC Regulations.

1031 CABLE RECORDS:

Keep records of cable drum numbers and supporting information, mark information on record drawings, indicating precise location of each length of cable, and submit copies of manufacturer's cable test certificate.

1032 CABLE DESCRIPTIONS IN SCHEDULES

See Y61 Schedules for particular requirements of cables.

2000 PRODUCTS/MATERIALS

2005 LSOH SHEATHING:

Supply cables with Low Smoke Zero Halogen (LSOH) sheathing, tested in accordance with relevant parts of BS EN 60754 (parts 1 and 2) and relevant parts of BS EDN IEC 60332 and BS EN 60332.

2011 FLEXIBLE MULTI-CORE CABLES AND INDUSTRIAL CABLES:

All flexible cables and industrial cables shall have copper conductors and be rated at 300/500V for single phase and standard duty applications and 450/750V for three phase and industrial/heavy duty applications, unless otherwise indicated. Performance characteristics shall be suitable for the application.
Standard – relevant parts of BS EN 50525 to suit types scheduled.

2021 STANDARD WIRING AND POWER CABLES:

All wiring and power cables shall have copper conductors unless otherwise indicated. All cables shall have a voltage rating and performance characteristics suitable for the application. For multicore cables the conductors shall be circular up to 16mm^2 and shaped over 16mm^2 unless otherwise indicated. LSF means Low Smoke and corrosive gas emission compound.

Standard BS 7211 - thermosetting insulated and thermoplastic sheathed cables for voltages up to and including 450/750 V for electric power and lighting and having low emission of smoke and corrosive gases when affected by fire (class 1 solid copper conductors)

2031 STANDARD MEDIUM VOLTAGE (MV&HV) POWER CABLES:

All power cables shall have copper conductors unless otherwise indicated. All cables shall have a rated voltage and performance characteristics suitable for the system.
Unless indicated otherwise, voltage ratings cables shall be selected for Category A in accordance with BS 6622 (phase to earth faults shall be disconnected from the system within 1 minute).

2041 MINERAL INSULATED WIRING AND POWER CABLES:

Standard – BS EN 60702-1
All conductors shall be copper unless otherwise indicated. All cables shall have an outer sheath as indicated. 500V light duty cables shall be used for sizes up to 2.5mm^2, 750V heavy duty cables for sizes over 2.5mm^2 to 25mm^2 and 750V heavy duty single core cables for over 25mm^2 unless otherwise indicated.
Outer sheath colours shall be:-

Red	-	Fire Alarms
White	-	Emergency Lighting
Orange	-	Other Services

Fire performance standards - BS 5839-1, BS 6387 BS 8519 as appropriate.

2051 CONTROL AND AUXILIARY CABLES:

All conductors to be copper unless otherwise indicated.
Standards - BS EN 50288-7, BS 5467, BS 6346, BS 6724, BS 7211, BS 7629, BS 7846, BS 7870, BS EN 50288-7 as appropriate to the particular project / schedules.

Fire performance standards - BS 5839-1, BS 6387, BS 8519, BS EN 50200 as appropriate to the particular project / schedules.

2071 STANDARD COMMUNICATION CABLES:

For outdoor or underground use:

Standards BS EN 50288-7, BS EN 60708, BS EN 62012-1 as appropriate.

2075 CABLES FOR RESIDENTIAL TELECOMMUNICATION:

Standard: BS EN 50441 parts 1-4.
Sheath material:
LSOH - BS EN 50290-2-27.
BS EN 50290-2-22.

2080A STANDARD COAXIAL CABLES:

Standards Relevant parts of BS EN 50117 and BS 61196

CAI cable types to BS EN 50117, CT 100, CT 125, CT 165, as appropriate. Provide cables with CAI benchmarking status.

2080B STANDARD RADIATING COAXIAL CABLES (LEAKY FEEDER) FOR WIRELESS NETWORKING (WIFI):

Standard -BS EN 61196-4
Characteristic impedance -50 Ohm
Operating frequency 2.4 Ghz or 5.0 Ghz

2091 OPTICAL FIBRE CABLES:

Standards
Relevant parts of BS EN 60794.
Parts BS EN 60794-2 for Indoor cables.

Parts BS EN 60794-3 for outdoor cables.
Quality assessment of indoor cables to BS EN 187103
Standard indoor optical fibre cables for data communications to BS EN 60794-2-10, BS EN IEC 60794-2-11 and BS EN 187103.
Refer to schedules / scope of works for category of multimode fibre to BS EN 60793-2-10
Fibres to relevant parts of BS EN 60793 / BS EN IEC 60793
Fibre optic interconnecting devices and components to BS EN 61300, BS EN 62148, BS EN 62664-1-1 and PD IEC/TR 62627-03-03.

2101 INFORMATION TECHNOLOGY OR SPECIALIST SYSTEMS CABLES

Provide IT or Special Systems cables in accordance with the system suppliers' specification.
Structured Wiring: Refer to work section W70 for cable category and details.
Standard – relevant parts of BS EN 50173 and relevant parts of BS EN 50288
Termination reference EIA/TIA TSB-40
Common construction – Multi pair; unshielded (UTP)
Information Technology cables:
Standards-BS EN 50090-9-1, BS EN 50098-1, BS EN 61196, EIA/TIA 568.
LAN - Ethernet - reference BS ISO/IEC/IEEE 8802-3.

2170 PRE-FABRICATED WIRING SYSTEMS – SYSTEM REQUIREMENTS AND MANUFACTURING

Also refer to clause Y61 4210 for Cable installation, schedule Y61sch3 for details and V22 for scope of works.

Standards

The requirements for fixed wiring installations in accordance with BS 7671 (IET Wiring Regulations).

The safety requirements of BS 8488

BS EN 61535 for installation couplers and distribution blocks.

BS EN 61984 for connectors associated with LV switchgear and controlgear to BS EN 61439-series

BS 5733 or BS EN 61439 for connecting, terminating, coupling and branching points where BS EN 61535 is not applicable.

BS 6701 and BS EN 50174-series for assemblies incorporating information technology and similar cables.

Systems shall comprise of Home Run cables, Master Distribution Boxes (MDB's), extender cables, connectors, fused tees and luminaire flex tees.

Refer to Schedule Y61sch3 for details of the system.

Connectors

All connections with the exception of those to be terminated within the distribution boards shall be pre-terminated into 'snap-fit' plug and socket connectors

Different distinct types of connectors (colour coded and keyed) shall be used on MDB ports and extender cables to differentiate between circuit ratings (generally lighting circuit shall be rated at 20A and power circuits rated at 20A or 32A), to prevent different rated circuits being interconnected.

Connectors shall incorporate a locking mechanism to prevent accidental disconnection, and shall be maintenance-free, screwless, without terminal blocks. The minimum degree of protection in accordance with BS EN 60529 shall be:

IP31 in areas only accessible to skilled and instructed persons as defined in BS 7671.

IP41 in all other areas.

Cables

Ensure cables are selected in accordance with BS 7671 (IET Wiring Regulations)

Ensure cables cater for grouping and other relevant correction factors required by BS 7671 (IET Wiring Regulations) based on the number of circuits and circuit ratings.

Ensure home run and extender cables incorporate separate circuit protective conductors for each circuit.

Home Runs and Extender cables shall incorporate separate circuit protection conductors for each circuit.

On metallic sheathed systems, the sheath shall be earthed and provide full 360-degree bonding onto the casing of the connectors.

Ensure pre-fabricated wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

Where pre-fabricated wiring systems incorporate signal wiring for building control systems, it shall be ensured that the type of signal cable used is suitable for the system protocol and combination with the LV circuit wiring. The assembly shall meet the safety requirements of BS 7671 for separation of different voltage bands, and the requirements of BS 7671 and BS EN 50174-series for segregation and separation for electromagnetic compatibility. Arrangement of signal cables shall maintain the required network topology and not exceed maximum network lengths.

MDB's shall comprise of a steel enclosure with output ports located around the perimeter, external fixing lugs shall be provided to prevent damage to the internal wiring.

Cables are to be continuity and polarity tested at the works and each passed cable assembly is to be serial numbered with the recorded data detailed on the product. Once integrated into the works the Pre-Fabricated wiring shall be fully re-tested as part of the fixed installation in accordance with Chapter 61 of BS 7671.

All wiring systems for circuits where protective conductor currents may exceed 10 mA shall comply with Regulation group 543.7 of BS 7671.

3000 ACCESSORIES

3011 CABLE GLANDS:

Standard BS 6121-1, BS EN 62444

Cable glands shall be suitable for the type of cable, environment and mechanical forces present all glands shall incorporate a method of cable retention. Metallic glands to be brass except where aluminium gland plates are provided where nickel plated brass glands shall be used, include shroud (LSOH for cables with LSOH sheath) and for metallic sheathed or armoured cables shall incorporate armour locking ring and earth tag for protective connection to earth.

Cable type	Application	Cable type	Gland type				
			Material	Cable retention	Ingress Protection to BS EN 60529	Type to BS EN 6121-5 Annex A	Environment
Unarmoured, Flexible;	Indoors	Wiring and power; control and auxiliary; and communications	Non-metallic	Class A	IP54	Type A1	Indoor
	Outdoors			Class A	IP66	Type A2	Outdoor
Armoured cables	Dry Indoors	Wiring and power; control and auxiliary;	Metallic	Class A	IP54	Type B	Dry Indoors
	Indoors				IP54	Type B	Indoors
	Outdoors		Metallic	Class A	IP66	Type C	Outdoor

Where a cable gland or armour gland is required which has resistance to extreme conditions not covered by the requirement specified in BS EN 62444 or BS 6121 (e.g. resistance to chemical attack, resistance to ingress of water in deluge conditions, resistance to strong ultraviolet light), advice should be sought from the gland manufacturer.
Cable glands used with fire performance cables shall be such as to minimize the probability of early failure in the event of fire.
Cable glands shall be certified to relevant parts of BS EN IEC 60079/BS EN 60079 for hazardous areas.

3021 CABLE SEALS AND GLANDS - MINERAL INSULATED CABLES:

Comply with BS EN 60702-2
Use seals and glands for mineral insulated cables in accordance with BS EN 60702-3, recommended or supplied by cable manufacturer for the type and temperature rating of the installation classification.
Gland type shall be cable grip type, externally threaded with lock washer and nut. Seal type shall be Self-threading pot and the pot closure shall be as manufacturer's standard for type of seal specified.
Pot sealant compound / glazing flux shall be suitable for the temperature rating required and environment.
Use Medium Temperature seals (150°C) for terminations associated with life safety equipment.
Cable glands shall be certified to BS EN 60079-14 for hazardous areas.
Gland shroud material and shroud colour to match cable sheath.

3031 VOLTAGE SURGE SUPPRESSORS FOR CABLES:

Provide voltage surge suppressors in accordance with cable and equipment manufacturer's recommendations. Suppressors shall be suitable for the rated voltage, connection arrangement and characteristics for the load concerned.
Standard
BS CECC 42200

3035 CABLE CLEATS AND CABLE TIES:

Use cable cleats to BS EN 61914.
Use cable ties to BS EN 62275.

3041 CABLE TERMINATING AND JOINTING SOCKETS:

Unless otherwise indicated all cables shall be terminated using approved cable lugs, ferrules, and spade type connections to suit the terminal arrangements of all devices, instruments and equipment.
Standard
Compression to: BS EN 61238-1
Clamping units to: BS EN 60999
Telecommunication and data cable IDC to : BS EN 60352-3

3051 INSULATING TAPE/OVER SLEEVING AND HEAT SHRINK SLEEVING:

Shall be of same material as the cable insulation.

Tape to BS 419
Standard
BS 3858
Relevant parts of BS EN 60454

3061 CABLE JOINTS AND TERMINATIONS:
Use cable joints as supplied and approved by cable manufacturer for the application and installation involved.
Standard
BS 7888
BS 7197 for performance of bonds
BS EN 50393
BS EN 61442
BS EN 60998
Core sleeving – relevant parts of BS EN 60684

3065A LIGHTING INSTALLATION COUPLERS:
Where scheduled or described in the scope of works, use only lighting installation couplers approved by cable manufacturers and to BS EN 61535 of rated voltage 230V and current rating 10A with rewireable or non-rewireable connections suitable for readily accessible locations with earth contact and for rigid or flexible cables.

3065B SMALL POWER INSTALLATION COUPLERS:
Where scheduled or described in the scope of works , use only small power installation couplers approved by cable manufacturers and to BS EN 61535 of rated voltage 230V and current rating 16A with rewireable or non-rewireable connections suitable for readily accessible locations with earth contact and for rigid or flexible cables.

3071 PAPER INSULATED CABLE ACCESSORIES
Use cable joints as supplied and approved by cable manufacturer for the application and installation involved.
Standard
BS 7197 for performance of bonds

3081 CONNECTORS FOR COAXIAL CABLES: (NES 261.200)
Connectors to be suitable for the application and to match the equipment.
Standards
Relevant parts of BS 3041, IEC 60169
Relevant parts of BS EN 60169
BS QC 221100
BS QC 221300
BS QC 221400
BS QC 222000

BS EN 61169-2 - 'Belling' or 'Standard 75Ohm TV' connector.
BS EN 60169-24 or BS EN IEC 61169-24 - Type F.

3091 OPTICAL FIBRE TERMINATIONS :
Terminations to be suitable for the application, fibre style, terminated fibre type and required installation characteristics.
Standard
BS EN 50377
BS EN 60874 series
BS EN 61754 series
BS EN 186110
BS EN 186150
BS EN 186160
BS EN 186220
BS EN 186230

BS EN 186260
BS EN 186270
BS IEC 60874 series

3101 OPTICAL FIBRE CABLE JOINTS

Joints shall be suitable for the style, and required installation characteristics.
Standard
BS EN 61073-1

3111 CABLE DUCTS:

Provide cable ducts as indicated on Schedules and drawings.
Standard
BS EN 61386-24 for conduit systems buried underground
All cable ducts and joints shall have a smooth internal bore.
Cable ducts for electricity cables shall be colour coded black. Cable ducts for other services shall be colour coded in accordance with Table 1 and Table 2 of NJUG Volume 2.
Cable ducts for the Distribution Network Operators shall be to NJUG Volume 2 unless supplied by the Distribution Network Operator.

3121 CABLE SLEEVES:

Supply and hand to others for installation non ferrous cable sleeves for incorporation into the structure where cables pass through fire compartment floors and walls. The contractor is responsible for sealing cable sleeves following installation of cabling, method of sealing to be appropriate to prevent water ingress and maintain fire integrity, as applicable. Sleeving to be in accordance with BS EN 60684.

3131 CABLE COVERS AND MARKERS

Cable covers are to be manufactured from concrete indented lettering warning of the danger electricity below.
Cable covers are to be wider than the width of the service cables that they are protecting.
Plastic warning tapes to be yellow with blue legend in accordance with BS EN 12613.

4000 WORKMANSHIP

4011 CABLE INSTALLATION - GENERAL:

Use and install cables only as directed in the appropriate standard or as directed by the manufacturer in writing. Lay cables in one length unless otherwise indicated. Obtain permission from supervising officer for all through joints, and where overall length requirement exceeds practical drum size.
Handle, install and dispose of cables on wooden drums in accordance with BS 8512.
Install cables when ambient temperature is 5°C or greater, using cables stored at or above this temperature for not less than 24 hours. (Refer to manufacturers' recommendations for bitumen covered cables etc).
Use drum stands, drum axles, fair leads, rollers, cable stockings and other equipment as recommended by the cable manufacturer and as appropriate to the method of installation. Ensure over sheaths are not damaged by abrasion or scuffing.
Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4012 CABLES INSTALLED EXTERNALLY

Where cables are installed externally and exposed to solar radiation, the Electrical Contractor shall ensure that the cables used are of a type which do not deteriorate as a result ultra-violet radiation. Additionally cable ladders or trays provided for power cables shall be fitted with ventilated covers to provide protection against solar radiation / gains.

4020 CABLE INSTALLATION IN LOW TEMPERATURES:

Install cables at lower installation temperatures when authorised by manufacturer in a written statement.
Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4030 INSTALLATION OF LSF CABLE:

Install LSF cables in accordance with manufacturer's instructions. Ensure ambient temperature is above 5°C. Ensure oversheaths are not damaged by abrasion or scuffing.
Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4030A INSTALLATION OF LSZH CABLES:

Install LSZH cables in accordance with the manufacturer's instructions, ensuring the ambient temperatures are above the minimum specified by the manufacturer.
Install LSZH cables so that they are not exposed to concrete or other substances containing products similar to lime.
Where LSZH cables are installed outside containment, directly on concrete floors (e.g. under raised floors in offices, control rooms or data centres) ensure suitable cable mat products with appropriate fire performance are used.
Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4031 CABLE ROUTING

Minimum spacings between cables and other services;
Insulated Steam Services 300mm
Other mechanical services (excluding steam) 150mm

The minimum spacings (taken from outside surfaces) between LV cables and containment for cables for telecommunications, control and other sensitive circuits (installed in air) shall be in accordance with A444 of BS 7671. For HV cables a minimum separation distance of 1,000mm to LV cables and 1,400mm to telecommunications, control and other sensitive circuits shall be provided.
Where cables are specified as being routed by 'diverse' routes, each cable shall be run along a route of low risk from fire or mechanical damage and where possible within separate fire compartments. Where cables enter common rooms, entries shall be separated by a minimum of 4m. Under no circumstances shall the cables forming both groups, be run on the same containment.

4040 INSTALLATION OF UNARMOURED CABLES

Install and use unarmoured cable to BS EN 50565-1, BS EN 50565-2 or the manufacturers written instructions.
Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4051 CABLE TRENCHES:

Cable trenches to be by others but supervision of all works is to be carried out by Electrical Contractor.
Work in adopted streets to comply with the New Roads and Streets Works Act 1991.
Carry out walk over survey of trench route, dig trial holes in any area considered to be potentially difficult.
Establish location of any other underground service adjacent to cable route.
Re-plan cable routes after survey and trial holes, Submit report of survey and trial holes. Carry out any instructed work to adjacent services. Set out cable trenches, excavate trench carefully setting aside any materials required for backfilling or reinstatement. Excess excavated material to be removed from site.
Minimum cover in cable trenches

HV cables 800mm; LV cables 500mm; communications cables 500mm; all cables 800mm under roadways.

Trench

Common trench for all underground services

Grade trench bottom to a maximum slope of 1:12.
Clear trench bottom of loose stones and place bedding to full width of trench.
Bedding - Riddled earth 6mm grid for cables; riddled earth 12mm grid for ducts; imported soft sand; or pea shingle for ducts.

Bedding thickness – 75mm; or 100mm for ducts.
Install cables or ducts. Haunch cables or ducts in bedding material to a minimum depth of 75mm above highest cable or duct.

Warning tapes to be installed in accordance with the following table :-

WIDTH→	up to 600mm	600-1000mm	1000-1400mm	1400-1800mm
DEPTH up to 500mm	1 tape at 200mm below ground level in the centre of the trench	2 tapes at 200mm below ground level horizontally spaced 400mm apart	3 tapes at 200mm below ground level horizontally spaced 400mm apart	4 tapes at 200mm below ground level horizontally spaced 400mm apart
DEPTH 500-800mm	1 tape at 200mm and 1 tape at 500mm below ground level in the centre of the trench	2 tapes at 200mm and 2 tapes at 500mm below ground level each tape on each level horizontally spaced 400mm apart	3 tapes at 200mm and 3 tapes at 500mm below ground level each tape on each level horizontally spaced 400mm apart	4 tapes at 200mm and 4 tapes at 500mm below ground level each tape on each level horizontally spaced 400mm apart

Backfill trench using two layers 100mm thick hand rammed. Complete backfilling in layers and reinstate trench.
Backfill material – as excavated from trench.

4061 CABLE INSTALLATION IN TRENCHES:

Lay cables on newly prepared bedding. Ensure multiple layers of cable are separated vertically by a 50mm layer of hard rammed bedding material. Cover newly laid cables with 100mm of bedding material.

When using a power winch ensure tension on the cable is taken by element of the cable designed for that purpose; that is armour or conductor cores as appropriate and not plastic sheath, metal sheath or core insulation.
During hand pulling cable ensure no kinks are formed and that flaking when used is one in the correct direction.
Do not allow cable to twist during installation. Use swivels to connect pulling bond to cable stocking or equivalent fitting.
Check drum is suitable for jacking before commencing installation. If drum or reel is unsuitable for jacking, flake cable in correct direction in maximum size turns from drum or reel before commencing installation. Use skilled labour to supervise all unreeling, flaking or running of cable from a drum.
Lay cables in the formation shown, ensure spacing is not reduced below that indicated.
Bind trefoil groups at 1m intervals. Bind any associated earth or protective conductor to its cable or trefoil group at 1m intervals.
Space multiple cables in trenches in accordance with BS 7671.
Ensure installation radii and permanent bending radii are not less than those recommended by the manufacturer.
Do not lay cables to BS 7211 or BS EN 50525 direct in the ground

4071 CABLE DUCTS:

Duct work - Carry out all duct laying where specified.
Lay ducts, jointed in accordance with the manufacturer's instructions, in the formation shown on to newly prepared bedding.
Ensure that ducts slope no more than 1:60 vertically or 1:30 horizontally.
Ensure that pre-formed duct bends used at ends of duct routes meet the requirements of the cable manufacture for bending radii.
Construct manholes, draw pits and jointing chambers, as indicated.
Prove alignment of completed duct run by drawing through a mandrel of diameter 7mm less than nominal duct bore of minimum length 250mm. Clean completed duct run by drawing through a circular wire brush of diameter 12mm more than nominal duct bore.
Install in each empty duct a draw wire of corrosion resistant material of minimum breaking strength 550N.
Plug and seal all ducts on completion with proprietary duct plugs.

4080 CABLE INSTALLATION INTO DUCTS:

Install cables into newly proved and cleaned duct. Use lubricants, recommended by the cable manufacturer in writing, to assist drawing process.
Flake cable if drums or reels are not suitable for jacking. At intermediate draw pits with exit duct more than 15° off line of entry duct flake cable before entering or provide comprehensive system of corner plates, roller and blocks. Use the maximum practical size of turns when flaking and ensure direction of flake is correct.

Do not exceed manufacturer's installation tension on cable and ensure the pulling tension is taken on cable elements designed for that purpose, that is armour or conductor cores and not on other elements, such as plastic sheath or conductor insulation.
Do not allow cables being pulled into ducts to twist. Use appropriate swivel between pulling bond and cable stocking or similar appliance.
Bind trefoil groups of single core cables installed into a single duct at 1m intervals. Install earth or protective conductors into the same duct as the associated cable where practical, binding the two together through manholes, draw pits and jointing chambers. Pull all cables in one duct as a group. Ensure the group does not twist or cross over. Report any damage to cable sheath during installation and carry out any instructed work to remedy the damage.
Seal between cable and duct ends after cable installation. Ensure cable ends in jointing chambers are temporarily sealed where required.

4091 CABLE INSTALLATION IN CONDUIT AND TRUNKING:

Install cables so that they are orderly and capable of being withdrawn.
Arrange single core wiring generally using the loop-in method.
Trunking - In vertical trunking provide pin racks at 3m intervals. Use ties for all wires of the same circuit reference at 2m intervals. Mark ties at 10m intervals with circuit reference number.
Conduit - Provide cable clamps in conduit boxes at 10m intervals in vertical conduit.
Allow for full range of movement at building construction movement joints. Make all joints to wiring at terminal blocks in conduit boxes/adaptable boxes to suit cable size.
Where wiring is to be drawn into existing wired conduits, withdraw existing wiring and replace.
Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4100 CABLE INSTALLATION ON TRAY AND RACK:

Place cables side by side or as indicated, fix using cleats or metallic cable ties so that any cable may be individually removed.
Ensure that any cables not sitting on the top surface of the tray or rack are secured so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4111 CABLE SURFACE INSTALLATION:

Dress cables flat, free from twists, kinks and strain, and align parallel to building elements. When glands and clamps are not required, take sheathing of cables into accessory boxes and equipment and protect against abrasion using grommets or similar sharp edge protection.
Clearance as determined by fixing method unless otherwise indicated. Use metallic clips on cables with specified fire performance. Cable cleats to BS EN 61914.
Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4121 CABLE EMBEDDED INSTALLATION:

Dress cables flat, free from twists, kinks and strain, and align parallel to building elements. When glands and clamps are not required, take sheathing of cables into accessory boxes and equipment and protect against abrasion using grommets or similar sharp edge protection. Ensure plaster or screed over cable is a minimum of 12mm. Protect embedded cables (not complying with BS 8436) by metal capping.

4131 CABLE INSTALLATION - MINERAL INSULATED CABLES:

Straighten and dress cables using methods and tools recommended by cable manufacturer.
Use thermoplastic or LSF sheathed cables, colour and location indicated and where cables may come into direct contact with any material that may be corrosive to copper.
Fit temporary seals to mineral insulated cable end when cut.
Fit temporary seals to mineral insulated cable if the cable is left unterminated underground, or where the termination is not to be made within 12 weeks.
Allow extra length on installed cables for cutting back of moisture affected ends. Store mineral insulated cables in the form supplied by manufacturer.
Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4140 CABLE INSTALLATION - FLEXIBLE CORDS:

Grip cords securely at connections. Where they do not form an integral part of the connected accessory or equipment, provide separate proprietary cord grips.
Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).
Ensure that any cables not sitting on the top surface of a cable rack or tray are secured so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4151 CABLE JOINTING AND TERMINATING GENERALLY:

Ensure all joints and terminations are made by appropriately qualified cable jointers, using jointing materials, components and workmanship recommended by the cable manufacturer and the jointing accessory manufacturer. Install cable glands in accordance with BS 6121-5. Cold pour resin and heat shrink joints:
Cut all cable ends immediately prior to jointing or terminating. Seal cables left unconnected for more than 24 hours to prevent the ingress of moisture.
Seal plastic sheathed cables using proprietary shrink on end caps. Seal lead sheathed cables by a plumbed dressed lead cap with an air space to allow conductor movement.
Strip cables to bring out the cores and expose conductors, for the minimum length required for connection, to leave no exposed length of conductor after termination. Ensure that strands are not damaged when stripping cable cores. Twist strands together. Do not reduce number of strands. Secure all strands at terminations.
Clean armour thoroughly prior to joining or terminating.
At connections to equipment and switchgear without integral cable clamping terminals, use compression or solder type lugs for bolted terminal connections, of correct bore. Form all compression connections to components using tools that cannot be released unless the correct degree of compression has been achieved. Install and inspect compression and mechanical connectors in accordance with BS EN 60228 and BS 7609.
Bolt core terminations with lugs to equipment using washers or proprietary shakeproof devices. Provide separate bolted connection for each core.
For auxiliary and sub-circuit wiring do not bunch more than three cores at clamping terminals or bolted connections. Individual stranded cores should be twisted together and folded back to form a "U" where entering screw or clamp type terminals.
Mark cable conductor phasing, or other core identification, at each end of all cables, and at all joints, maintaining consistency of marking with any existing system.
Connect all cores, including multicore cable spare cores, at all joints and terminations. Bond any unused cores of multicore cables to earth at both ends, unless otherwise indicated.

4161 CABLE JOINTING AND TERMINATING - PAPER INSULATED CABLES:

Make cable joints and terminations using the material and methods recommended by the cable manufacturer. Employ only labour certified by cable manufacturer as qualified to make paper insulated cable joints. Cold pour resin and heat shrink joints
Ensure cores are insulated and separated using compatible materials. Keep all materials for paper insulated joints in sealed containers until used. Use only cable manufacturers approved jointing materials for type and application involved. Where proprietary mechanical glands and armour clamps are not used, use tinned brass wiping gland and armour clamp plumbed to sheath.

4171 CABLE JOINTING AND TERMINATING - ELASTOMER AND PLASTIC INSULATED CABLES:

Joint cables using glands of the type indicated, in accordance with the manufacturer's instructions. Use shrouds at all glands unless otherwise instructed, match material and colour of cable sheath.
At core connections to equipment without integral clamping terminals use compression lugs unless otherwise indicated.

4181 TERMINATING - MINERAL INSULATED CABLES:

Use terminations in accordance with BS EN 60702-2 and components and materials recommended or supplied by cable manufacturer.
Use seals of the maximum temperature rating indicated, with stub caps to the largest size available, with drilled caps and headed sleeves for larger sizes.
Use glands of type indicated, except at terminations to accessory boxes within a plaster or render finish, where cable clamps fixed to accessory box and firmly gripping cable sheath may be used. Use earth tail seals with sheath grip type accessory boxes.

Secure glands at equipment not provided with threaded entries using lock washers and locknuts or brass conduit bush. Use gland shrouds when plastic covered MI cables are used to the same colour and material as cable oversheath.
Using thermoplastic, PIB or LSF material tape to BS EN 60454 to match sheath, tape overall gland any bare copper sheath and form seal to cable sheath, under all shrouds.
Mark core sleeving with appropriate identification.
Install voltage surge suppressors in accordance with manufacturer's recommendations and, to BS 7671 Section 331-01-01 or as otherwise indicated.

4191 CABLE JOINTS - MINERAL INSULATED CABLES:

Joint mineral insulated cables using methods and materials recommended by cable manufacturer. Terminate cables in externally threaded glands using seals of temperature rating indicated. Join conductors using crimped connectors, as required.
Insulate connectors using thermoplastic tape to BS EN 60454, ensuring good seal to conductor sleeving. Make off glands into either end of internally threaded brass sleeve of correct size. Protect brass sleeve using heat shrink sleeve, unless otherwise indicated.

4201 COMMUNICATIONS COAXIAL, OPTICAL FIBRE AND DATA CABLE JOINTING AND TERMINATING:

Use methods approved by cable and accessory manufacturers. Employ only labour certified by acceptable body as qualified to make joints and terminations in the referenced cable. Obtain in writing approval of cable manufacturer for accessories not supplied by them.
Ensure cable protection mats are used in basket in which unarmoured copper cables are installed, where cable deformation may affect signal / data performance (e.g. Category 6 and Category 6a applications).
Identify cables using structured numbering scheme.
Install optical fibre cables in accordance with BS EN 50174-2 and BS EN 50174-3.
Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).
Ensure that any cables not sitting on the top surface of a cable rack or tray are secured so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4210 CABLE INSTALLATION – PRE-FABRICATED WIRING SYSTEMS

Ensure that the manufacturer prepares drawings, detailing the installation and identifying each component of the pre-fabricated wiring system, and its location.
Ensure connectors are only installed in dry environments, and not within wet areas such as showers and bathrooms.
Ensure connections are located such that they are accessible after all works are completed, for maintenance and inspection and testing.
Ensure home run cables are fixed directly to the soffit. Where groups of 2 or more cables are run together these shall be run on cable baskets or trays.
Ensure extender cables are clipped to the soffit or structural elements, independent of ceiling supports.
Ensure pre-fabricated wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).
Ensure home run and extender cables are installed such that they are supported clear from the ceiling and run along the lines of the ceiling grid so that they do not restrict access to the ceiling void or other services.
Ensure all cables without mechanical protection suitable to protect against penetrate by screws, nails and similar, or without protection by and earthed metallic armour or sheath rated as protective conductor for the circuits enclosed, and installed within partitions are routed in accordance with permitted cable routes and, if installed at a depth of less than 50 mm, protected by a 30 mA RCD, in accordance with BS 7671 (IET Wiring Regulations).
Ensure un-used connectors are fitted with end caps.
Ensure all connectors in which protective conductor currents may exceed 10 mA have a label complying with BS EN ISO 7010, incorporating safety sign W012 (electricity warning triangle with lightning bolt) with the following words in black on a yellow background: "WARNING. HIGH PROTECTIVE CONDUCTOR CURRENTS. ISOLATE CIRCUIT BEFORE DISCONNECTING."
Cables are to be continuity and polarity tested at the works and each passed cable assembly is to be serial numbered with the recorded data detailed on the product. Once integrated into the works the pre-fabricated wiring shall be re-tested as part of the initial verification of the fixed installation in accordance with BS 7671 (IET Wiring Regulations).

4211 **CABLE SLEEVES:**

Pack sleeves with fire resistant material after cable installation in accordance with the designated fire rating of the area involved and to comply with Building Regulations.

Cables shall be cleats, cable ties or cable supports shall be installed within 750mm each side of cable sleeves and shall be suitable to withstand the mechanical loads expected following collapse of the supports on the fire side of the sleeve, to the extent that no strain is transferred to the seal.

4212 **MARSHALLING TERMINAL BOXES**

Standard - BS EN 60670-22 and relevant parts of BS EN 60947-7.

Provide steel enclosure to IP 31 (indoor) or IP 65 (outdoor) with lockable hinged lid, DIN rail mounted terminals, 25A minimum, labels and warning signs.

Arrange terminals in single or three phase, or function order groups with spacer plates between groups, end stops and clamps at each end of rail.

Number each terminal and fit each conductor with identification ferrules, cross-referenced to circuit charts and as installed drawings.

10000 **NES** VERSION TEXT Y61 Dec 19

1000 **GENERAL**

1010 **APPLICATION:**

Cables referred to in this section are only those types that can be installed without further mechanical protection.

1012 LAYOUT AND SEGREGATION

Set out cable support systems as indicated in diagrammatic form on the drawings. Provide all necessary offsets, bends, tapers, transformation pieces etc. required whether or not these are detailed. The layout of the systems and the routing of cables shall ensure maximum circuit lengths and grouping shown on drawing and schedules are not exceeded.

2000 PRODUCTS/MATERIALS

2011 CABLE SUPPORTS:

Support all cables throughout their length using conduit, trunking and enclosures, cable tray, cable racking, special support systems, cleated or clipped fixing direct to building fabric, or aerial catenary suspension systems, as required.

Ensure tray, racking and special support systems are continuous and firmly fixed to building fabric. Allow space for indicated cables + 30% spare, unless otherwise indicated.

Ensure cable support system allows for spacing in accordance with BS 7671 for the design current of the cable.

Ensure cable support system is installed so that cables are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

Cable support systems for fire rated cables shall afford the same resistance to fire as the specification for the cable to ensure continued operation of the circuit during a fire.

2012 FIXINGS FINISHES:

Ensure finish for all support components, fixings, hangers and accessories is galvanized or sherardized finish.

2021 CABLE SUPPORT SYSTEM: (NES 2020 and 2030)

Standard BS EN 61537

Material

Hot rolled steel galvanized after manufacture to BS EN ISO 1461; or bending and profiling quality hot dipped galvanized steel to BS EN 10143, and BS EN 10346.

Finish - Self colour galvanized.

Perforated tray.

Use return flanged type with manufacturer's standard perforations pattern, unless otherwise indicated. The thickness of the tray shall be the Manufacturer's standard thickness for type.

Cable rack (ladder)

Proprietary system of channel sections with return lip and compatible jointing and fixing accessories.

Cable basket.

Cable baskets to have 50 mm square grid and side walls.

Light duty to be 25 mm sides, medium duty 50 mm sides and heavy duty 75mm sides.

For under floor basket tray three independent supports legs shall be provided along each standard section of basket, where legs are required. Support leg depth as indicated. Every section shall have at least one connection point screwed to the floor.

Accessories and fittings shall be as manufacturers' standard items.

Include take-off plates for conduits, trunking etc.

Cable support system fittings

Use factory made fittings throughout of same material, type, pattern, finish and thickness as the cable support system, site modified fittings will only be acceptable on existing installations. Use reducers, inside angles, outside angles and drop outs as manufacturer's standard. Use flat bends, equal tees, unequal tees and crosses with gusseted corners. Join lengths of cable support system and fittings using manufacturer's standard shouldered ends, fish plates, or couplers, with galvanised or zinc plated slotted domed head 'roofing' bolts, nuts, washers and shake proof washers.

Each fitting shall have a bonding braid attached across it to form the continuous bonding of the support system.

Tray/rack supports - use threaded rod or proprietary support channel.

Ensure cable support system is installed so that the cables are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).
Ensure that any cables not sitting on the top surface of the support system are secured so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

2022 WIRE ROPE SUSPENSION SYSTEM:
Where specified within the Scope of Works or Schedules for the support of cable trays or baskets, use proprietary Wire Rope Suspensions Systems which comply with BS EN 12385-1, BS EN 13411-3, BS EN 13411-4, DIN 3093, and BSRIA COP 22/2002. Wire Rope Suspensions to be suitable for the safe working load and comprise Stainless Steel grade 316 wire rope, Stainless steel grade 302 Spring fasters with fixings by loops, stud (permanently fixed to wire rope length) or toggle as appropriate. The installation shall comply with BSRIA COP 22/2002 and 'solid' stud type suspensions shall be provided at maximum spacing of 20m, with a minimum of one in any straight run.

2026 CABLE CLIPS, TIES AND CLEATS
Standard BS EN 61914 (cable cleats)

Bolted cleats shall be aluminium alloy, galvanised iron or moulded black polythene. Galvanised iron cleats shall be used to fix fire rated cables.
Proprietary cable ties shall be wrap round self-locking releasable pattern. Cable ties may be Nylon except where used to fix power or fire rated cables, where stainless steel ties shall be used. Stainless steel cable ties shall be suitable to withstand the forces exerted by power cables under short circuit conditions, including a safety factor of 3.
Fixings used for fire rated cables shall sustain the same fire conditions as that provided by the cable, without failure.
Cable clips shall be the Polypropylene surface type with pre-fixed hardened steel pin for general use except on mineral insulated cables. For mineral insulated cables use bright copper one hole 'P' clips or two-way saddles (for runs of multiple cables) for unsheathed mineral insulated cables, PVC covered for sheathed mineral insulated cables
Use cable ties to BS EN 62275.
Ensure all wiring system components and cable supports are selected and installed so that wiring systems are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

3000 WORKMANSHIP

3011 CABLE SUPPORT INSTALLATION:
Support from building fabric with minimum clearance behind of 20mm. Install fixings at regular intervals to prevent visible sagging when loaded, with maximum spacing 1.2m and 230mm from fittings.
Keep cutting of cable tray to a minimum. Cut along a line of unperforated metal. Ends of hangers to be cut flush with locking nuts or support brackets. Make good finish with zinc rich paint, primer and topcoat, or two pack epoxy paste, as appropriate to material and finish.
Fit holes cut in tray for passage of cables with grommets, bushes or other lining. Install all bolts, fixings and hangers with threaded portion away from cables.
Ensure all wiring containment systems are selected and installed so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

3022 CABLE CLEATS, TIES, SADDLES AND CLIPS INSTALLATION:
Ensure all cable supports are selected and installed so that wiring systems are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

Single core cables forming part of a three-phase circuit shall be installed in trefoil formation whether installed horizontally or vertically and supported using proprietary trefoil cleats certified for the peak fault current that cable could be subjected. The cleats shall be spaced in accordance with the manufacturer's recommendations for the given fault level. Where necessary the neutral conductor shall be run adjacent to its set of phase conductors using quadrafoil cleats.
Single core cables forming part of a DC circuit or single phase and neutral non-life safety circuit when run horizontally on trays or ladders shall be installed 'flat touching' together with the associated earth cable. Each conductor shall be individually fixed using proprietary metallic cable ties to the cable tray or ladder at the spacings indicated in the table below. Marker ties shall be provided at 3000mm intervals which shall

encompass all conductors of the circuit. Where the cables run vertically, they shall be cleated using metallic cable cleats at fixing centres noted in the table below

Non-life safety multi core cables laid horizontally on cable tray or ladder shall be secured by the use of proprietary metallic cable ties or 'P' clips, securing the cables of only one circuit. The ties shall be spaced in accordance with the table below. Additional ties shall also be provided within 100 mm of each bend. Where non-life safety cables run vertically they shall be cleated using metallic cable cleats with spacings in accordance the table below.

Life safety multi core cables laid horizontally on cable tray or ladder shall be secured by the use of proprietary stainless-steel cable ties or 'P' clips, securing the cables of only one circuit. The ties shall be spaced in accordance with the table below. Additional ties shall also be provided within 100 mm of each bend. Where Life Safety cables run vertically, they shall be cleated in accordance with the table below. Cleats utilised for life safety cabling shall be as recommended by the manufacture for that type of cable and shall be manufactured from either cast iron or stainless steel.

Where cables are on inverted tray, they shall be fixed with cable cleats spaced in accordance the table below or the manufactures recommendations should they be more onerous. Cleats for non-life safety cables shall be stainless steel/metallic type, and cleats for life safety circuits shall be as recommended by the manufacture for that type of cable and shall be manufactured from either cast iron or stainless steel.

Where cables are to be installed direct to the structure they are to be supported by cleats bolted to vertical and/or horizontal mild steel galvanised channel supports which in turn shall be bolted to the structural walls or soffit at the required fixing centres for the cable fixings noted in the table below or the manufactures recommendations should they be more onerous. Cleats for non-life safety cables shall be stainless steel/metallic type, and cleats for life safety circuits shall be as recommended by the manufacture for that type of cable and shall be manufactured from either cast iron or stainless steel.

Insulated cable ties, P Clips and cleats shall be manufactured from materials with low smoke zero halogen properties.

The maximum spacing between cable cleats and fixings for cables in accessible positions is defined in the table below.

Overall diameter of cable(1)	**Type of cable and plane of cable installation**					
	Non-armoured cables		Steel Wire Armoured cables including fire resisting armoured cable		Mineral insulated copper clad or aluminium sheathed cables	
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
<9mm	300	300	-	-	600	600
9-15mm	300	300	300	300	900	1200
15-20mm	300	300	300	300	1500	1800
20-40mm	300	300	300	600		
40-50mm	600	600	900	900		
50-60mm	600	900	900	900		
60-70mm	900	1200	900	1200		
>70mm	900	1200	1200	1200		

Notes:

1. For flat cables taken as the dimension of the major axis.
2. Fire resistant fixings should be used for fire resistant cables.
3. The spacing's shown above apply to multi-core cables.
4. The spacing of fixings on single core cables in AC installations must take account of the magnitude of forces generated under fault conditions.
5. The spacing's stated for horizontal runs may be applied to runs at an angle of more than 30º from the vertical. For runs at an angle of 30º or less from the vertical, the vertical spacing's are applicable.
6. For cables supported on horizontal tray use ties for each circuit. Use tie manufacturer's special tensioning tool where available. Crop off tie ends.

7. For sub-circuit wiring on continuous flat surfaces of wood, plaster, brick etc. use polypropylene surface fixing clips with pre-fixed hardened steel pin for PVC insulated and sheathed cables and sheathed or bright mineral insulated cables. Use round or flat or flat twin pattern as appropriate, manufactured specifically for cable being fixed. Use one hole 'P' clips or two-way saddles of bright copper for unsheathed mineral insulated cable. Use PVC covered for sheathed mineral insulated cables.
8. Space cleats, ties, saddles and clips as Appendix G of Guidance Note 1 `Selection & Erection' published by the IET.

10000 NES VERSION Y63 TEXT Dec 18

1011 STANDARD:

Comply with all relevant parts of BS EN 61439 for Low-voltage switchgear and controlgear assemblies. Assemblies shall be type tested (TTA) in accordance with BS EN 61439-1 and BS EN 61439-2

1012 TYPE TEST:

Provide verification of type test in accordance with BS EN 61439 For type tested assemblies, the short circuit strength of main busbars, busbar supports, connections to incoming and outgoing units in the configuration to be used, shall be verified. Certificates issued by The Association of Short-Circuit Testing Authorities (Inc) - ASTA - are preferred, but certificates from other testing authorities will be considered.

1013 ELECTRICAL CHARACTERISTICS:

Ensure that electrical characteristics of component parts of assemblies are as indicated and apply when components are mounted in enclosures. Allow appropriate de-rating factors for effect of enclosures, other components and interconnections. Ensure that all components supplied and installed are suitable for Voltage, Current, Fault Levels and Frequency as scheduled.

1020 ELECTRICITY SUPPLY:

Ensure all electrical equipment supplied and installed is suitable for power supply indicated to BS EN 60038 and relevant parts of BS EN 61558

1014 INFORMATION ON DRAWINGS

The following electrical characteristics are shown on the system or the distribution diagram drawings:-

- Type of earthing system
- Number and type of live conductors at the origin
- Normal Voltage
- Frequency
- Maximum prospective short-circuit current at the origin (Ip(max)).
- Minimum prospective short-circuit current at the origin (Ip(min)).
- Earth-fault loop impedance at the origin (Ze)
- Electricity supplier's protective device and its tripping time at current Ip
- Protective devices
  - Current rating
  - Type
  - Category of duty

2000 PRODUCTS/MATERIALS

2011 SWITCHBOARDS / CONTROL PANELS, LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:

Standard – Relevant parts of BS EN 61439 as scheduled.

External design- Cubicle or Multi-cubicle type assembly as indicated on Schedules or drawings.

Degree of protection BS EN 60529

Indoors boards to be rated to IP31 unless otherwise indicated.

External boards to be rated to IP65

Electrical characteristics

Rated operational voltage 400V +10% / -11%

Service conditions

Ambient air temperature and altitude as relevant parts of BS EN 61439.

EMC-Environment A - Light Industrial/Commercial

Co-ordination in accordance with BS 7671 (IET Wiring Regulations)

Ensure that the relevant fault current (short-circuit) rating of each switchgear and controlgear assembly is greater than or equal to the maximum prospective fault current at the point of connection to the system.

Ensure that the relevant design current does not exceed the rated current of the system, or rated current of a circuit of the associated assembly, taking into account applicable diversity and loading factors.

Ensure that any devices and components are integrated into the assembly in accordance with the relevant parts of BS EN 61439.

Provide facilities to allow future extension of switchboard at either end.

2012 NEUTRAL POLES

Neutral poles on 4 pole circuit breakers or switches shall be rated in accordance with the most onerous conditions specified in BS 7671 and the relevant product standard.

2021 ASSEMBLY CONSTRUCTION:

Enclosure standard BS EN 62208
Material of enclosure - steel.
Supply doors with fastenings and provision for locking in closed position. Use covers which require special tools for removal. Large removable covers to be provided with lifting handles and location brackets. Provide enclosure with fixing holes. Where enclosure is mounted externally provide fixing lugs external to enclosure.

All busbars are to be fully rated for Current carrying capacity, Frequency, Fault Level and rated Voltage as detailed on the drawings and/or schedules. Neutral bars are to be fully rated and not ½ sized bars.

Internal Separation to BS EN 61439-1 and 61439-2 and as Schedules or Drawings
Assembly to provide protection against direct and indirect contact. Protection to be maintained after removal or withdrawal of removable or withdrawable parts.

Ensure that fixed panel or cubicle of withdrawable type units are fitted with label to identify circuit with wording identical to that on the withdrawable portion.

Terminals for external conductors
Accommodate cross-sectional area of cables scheduled.
Parallel cabling to be provided with an individual terminal for each cable.

Top hat rails dimensional type to BS EN 60715. Steel rails to be manufactured and finished in accordance with BS EN 60715 Appendix A.

Mark terminals as BS 7671 (IET Wiring Regulations).

Provide earth terminal, or for multi-cubicle enclosures a copper earth bar the full length of the enclosure, so that exposed conductive parts of the assembly can be connected to the protective conductor. Ensure earth connection can be made to the assembly without damage to the finish coating. Make provision for armouring and metal sheaths of all incoming and outgoing cables, including common and individual glanding plates, to be bonded to earthing terminal or bar.

Accessibility for inspection
Arrange for following operations to be performed when assembly is in service and under voltage.
Visual inspection of switching devices and other apparatus; settings and indicators of relays and releases; conductor connections and markings.
Adjusting and re-setting of relays, releases and electronic devices.
Replacement of fuselinks.
Replacement of indicating lamps.
Fault location by voltage and current measuring.
Accessibility for maintenance.
Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.

Short-circuit protection and short-circuit withstand strength as Schedules or drawings. Co-ordinate short-circuit protective devices and short-circuit current arising from rotating machines as detailed in Work Section V20. For motor control centres this information as detailed in Work Section W61.

Input voltage variations for electronic equipment supply as BS EN 61439.
Supply frequency deviation as BS EN 61439
Mounting - as scheduled or detailed in scope of works.

2031 ENCLOSURES FINISH:

Apply high standard finish to enclosure and supporting metalwork. Degrease metal and remove rust prior to applying finish.

Comply with paint manufacturer's recommendations regarding preparation, stoving times, temperatures, mixing of finishes, application and coat thickness.

Finish and colour as Manufacturer's standard unless otherwise stated in the schedules. When other than manufacturer's standard finish is specified samples for each paint system and for each colour shall be provided.

2041 TYPE TESTS:

Provide certificates of verification of

temperature rise limits.
dielectric properties.
short-circuit strength to relevant parts of BS EN 61439
continuity of protective circuit.
clearances and creepage distances.
mechanical operation.
degree of protection.

Temperature rise limits

Temperature rise test for test current greater than 3150 A to be agreed by the engineers.

Temperature rise when ambient temperature exceeds +40°C or is lower than +10°C to be agreed by the engineers.

Short circuit withstand strength

Value of neutral bar current for short-circuit test 60%.

2051 ROUTINE TESTS

Carry out the following Routine Tests at the works after the panels have been finished and before shipping to site:

Dielectric test
Insulation resistance test
Primary and/or secondary current injection
Phase rotation
Operation of protection devices, instruments and measuring devices
Operation of control and monitoring devices

The Engineers/design team/client shall be invited to witness these tests at a time convenient to them.

2052 TESTS ON SITE

Repeat routine tests on site.

2060 SITE BUILT ASSEMBLIES:

Ensure that components of site assemblies are part of a proprietary system and type tested as defined above. Install assemblies in accordance with manufacturer's drawings and instructions.

2070 SITE MODIFICATION:

Do not make site alterations unless authorised. Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions. Ensure that modifications made comply with type test certificate obtained for the arrangement of components.

2081 BATTERY CHARGER AND BATTERY UNIT:

Function, Input Voltage and Frequency as Schedules or drawings.

DC Output Voltage drop at full load 2%
Operating temperature range -10°C to +45°C.
Charger type Thyristor or Transistor.
Battery type Nickel Cadmium (maintenance free).
Enclosure, sheet steel,IP31
Corrosion resistant epoxy paint or Manufacturer's standard.
Colour Manufacturer's standard.

Facilities

MCB input protection.
Float charge.

Battery over-discharge protection
Fuses for battery protection.
MCB's for outgoing circuits as indicated.
Automatic selection of boost charge.

Meters
Battery voltage.
Charge/discharge current (dual scale for float and boost).

Lamp indications
Supply on.
Supply fail (monitor input terminals).
Float charge.
Boost charge.
No charge (when supply is on).
Battery voltage low.
Battery voltage high.

Earth fault on output.

Common Alarm (connected to operate a relay with shrouded 230V 3A AC or 0.5A DC. N/O-N/C volt free contacts, closed on any alarm, for remote indication circuit)
Supply failed.
No charge (when supply is on).
Battery voltage low.
Battery voltage high.
Earth fault on output.

2091 AIR-CIRCUIT BREAKERS

Comply with BS EN 60947-2. Provide fixed or isolating (withdrawable) removable type circuit breakers with provision for safe maintenance. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage and that Utilisation Category is B.

Withdrawable and plug-in circuit breakers shall be provided with an earthing device to permit earthing of either the busbar (main incoming devices only) or outgoing circuit, A minimum of 1No earthing device shall be provided for each frame size per switchboard.

Provide circuit-breaker with rated service short-circuit breaking capacity (Ics) and short-time withstand current (Icw) equal to or greater than that for the associated switchboard.

Provide operating mechanism, controls, accessories and protection as indicated on Schedules or drawings.

Provide a minimum of 3 (unless otherwise detailed or required) N/O-N/C volt free auxiliary contacts rated a minimum 10A 230V wired to external terminals within the outgoing cabling section.

Provide interlocks to prevent movement of the circuit-breaker within the housing when in `closed' or `service' position. Provide automatic shutters to cover all live contacts when circuit-breaker is isolated, withdrawn or removed from housing.

Provide facility to padlock circuit-breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when breaker withdrawn from housing.

2092 CIRCUIT-BREAKERS-MOULDED CASE

Comply with BS EN 60947-2. Provide moulded case isolating (withdrawable) or fixed type circuit-breakers, as detailed, with provision for safe maintenance. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage and that Utilisation Category is B.

Withdrawable and plug-in circuit breakers shall be provided with an earthing device to permit earthing of either the busbar (main incoming devices only) or outgoing circuit, A minimum of 1No earthing device shall be provided for each frame size per switchboard.

Provide circuit-breaker with rated service short-circuit breaking capacity (Ics) and short-time withstand current (Icw) equal to or greater than that for the associated switchboard.

Provide manual closing mechanism and protection by combination of adjustable magnetic/thermal compensating devices unless otherwise indicated.

Provide 2 (unless otherwise indicated or required) N/O - N/C volt free auxiliary contacts rated a minimum of 10A 230V AC wired to external terminals within outgoing cabling section.

Where withdrawable provide interlocks to prevent movement of circuit breaker within housing when in 'closed' or 'service' position. Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.

Provide facility to padlock circuit- breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.

2101 AIR BREAK SWITCHES DISCONNECTORS AND FUSE COMBINATION UNITS:

Supply fuse combination units in accordance with BS 88 (BS EN 60269)
Comply with BS EN 60947-3 and BS EN 62626-1.
Supply air break switches with uninterrupted rated duty and Utilisation Category AC 23 B (infrequent operation) unless otherwise indicated.
Utilisation category AC-3 where BS EN 62626-1 applies.
Operational performance not less than requirements of BS EN 60947-3, Table 4.

Fit fuse switches with cartridge fuse links in accordance with BS EN 60269, BS 88. Fit removable neutral link in switches controlling circuits with neutral conductor. Fit solid links in isolating switches. Fit each switch with facility to padlock in OFF position.
Ensure that withdrawable chassis isolating type switches are provided with fully shrouded fixed contacts or insulated cover plates, to prevent accidental contact with live parts.
Ensure that switches have individual enclosures and earth terminal, meet the degree of protection for the switchboard and have operating mechanisms interlinked with access door.

The means of operating (handle, push button etc) switches provided as the means of emergency switching shall be coloured red and the device facia shall be coloured yellow.

2111 PROTECTION DEVICES AND RELAYS

Comply with BS EN 61810.
Provide protection devices and relays as specified in the Work Sections, on drawings or Schedules.
Locate such that operation may be observed and the devices reset or adjusted without access to the interior of the enclosure.

2112 AUTOMATIC TRANSFER SWITCH EQUIPMENT (ATSE)

ATSE - Electromechanical ATS'S

Unless indicated otherwise in the Schedules, Electromechanical ATS's shall be enclosed within separate enclosures to their associated lv switchboards.

Where the transfer switch is specified with a draw-out function, shutters shall be provided which automatically close to fully shroud the live terminals when the transfer switch is withdrawn.

For closed transition switches, a timer shall be provided to limit the maximum period that the two sources are connected in parallel (adjustable 0 to 60secs), on expiry of the timer, the source 2 transfer switching device shall open.

Manual bypass facilities provided for test and maintenance purposes shall be incorporated within the ATS enclosure. The bypass shall allow the load to be connected to either of the sources without interruption of the supply to the load and shall be interlocked to prevent paralleling of the two sources.

Volt free contacts shall be located in a segregated section of the ATS enclosure.

ATSE - Interlocked Circuit Breakers
Shall comprise of motorised, 'plug-in' pattern non-automatic circuit breakers (Reference Y71.2091 & Y71.2092) mechanically and electrically interlocked to prevent both circuit breakers being simultaneously closed.

The incoming supply section for each device shall be segregated from the other and it shall be possible to remove either circuit breaker for maintenance purposes without disruption of the supply to the load. No live parts shall be exposed by removal of a device and a minimum of IP31 degree of protection shall be maintained.

It shall be possible to perform the following on the circuit breakers from the front facia of the switchboard without opening or removing covers:

Manual opening or closing of each circuit breaker

Padlocking the circuit breaker in their OFF positions for maintenance.

Circuit breakers shall incorporate an opening coil so that they may be opened upon failure of either source.

Mains sensing equipment shall be located within a separate controls section of the lv switchboard / ATSE Assembly.

Mains sensing shall be carried out by phase failure relays fitted to each supply phase which shall operate upon the voltage between any phase and neutral falling below a pre-set threshold for a pre-set period. After the pre-set period has elapsed and a voltage is sensed on the standby circuit breaker, the primary circuit breaker shall open and the secondary circuit breaker shall close.

Restoration of the normal supply shall be detected by the voltage between all 3 phases and neutral being above the pre-set threshold for a pre-set period.

After the pre-set period has elapsed the primary circuit breaker shall open, the secondary circuit breaker shall close.

Volt free contacts shall be fitted wired to a 'field wiring' terminal rail located within the controls section of the enclosure.

2131 TRIP/CLOSE SWITCHES AND CONTROL SELECTOR SWITCHES:
Standards - BS EN 60947-3 and BS EN 60947-5-1 as relevant.
Provide a panel mounted heavy duty, spring return key operated trip/close switch on each circuit- breaker fitted with electrically operated closing mechanism.
Ensure contacts have a continuous rating or AC and DC currents of 10A minimum at between 30V to 250V and make and break duty rating for AC and DC currents of 30A at 250V for a minimum period of 3 secs.
Where remote trip/close control is required, supply a panel mounted selector switch to select circuit- breaker for local or remote operation. Ensure that selection of remote or local closing does not prevent circuit breaker tripping under fault conditions.

2132 CONTROL CIRCUITS:
Control circuit voltage shall preferably not exceed 110 Volts ac (55-0-55)
Where control circuits are taken outside the enclosure to remote equipment use 24 Volts ac.
For circuit-breaker shunt trip and protective circuits use 30 Volt dc, for integral protective devices 230 Volts ac, or as otherwise indicated.
Provide control circuit transformers to supply power at voltages to suit control components in accordance with relevant parts of BS EN 61558 complete with primary and secondary fuses.

2140 CURRENT TRANSFORMERS:

Comply with BS EN 61869-2. Provide separate current transformers for each protection device and instrumentation. Ensure current transformers provide appropriate accuracy and are compatible with protective device characteristics, performance and VA rating required for satisfactory operation of protection devices, instruments and meters indicated.

Ensure that current transformers are capable of withstanding maximum short time withstand current of value and duration indicated for assembly.

Provide test links in secondary connections of all current transformers to facilitate testing of instruments, meters and protection devices.

2151 INSTRUMENTS AND METERS:

Standards

Comply with BS 89 series, BS EN 60051-1 and BS EN 60051-5 for voltmeters, ammeters, watt meters, frequency indicators and power factor indicators.

For static electricity meters, comply with:

BS EN 62502-11 for general requirements, tests and test conditions

BS EN 62052-21 for Tariff and load control equipment

BS EN 62052-31 for product safety requirements and tests

BS EN 62053-61 for power consumption and voltage requirements

BS 7856, BS EN 50470-1, BS EN 50470-2, BS EN 62053-22 or BS EN 62053-21 for kWh meters, kVA and kW maximum demand meters and polyphase reactive kVA meters

BS EN 62053-23 or BS EN 62053-24 for kVAhr meters

For electromechanical meters for active energy, comply with BS EN 62053-11, BS EN 50470-1, BS EN 50470-3 and BS 7856

Where a meter is to be used to measure the amount of electricity supplied for billing purposes, for applications up to 100kW/100kWh the meter shall be MID Approved. For applications above 100kW/100kWh meters shall be of an approved type for electricity, by OFGEM. In addition, meters for domestic use shall be certified.

Protect wiring to voltmeters by separate fuses. Protect potential coils of watt meters, frequency indicators, power factor indicators and kWh meters, kVA and kW maximum demand meters and polyphase reactive kVA meters by separate fuses.

Supply instruments and meters suitable for flush mounting and type, size and accuracy as drawings or schedules.

Ensure that indicating scales for all instruments comply with BS 3693. Supply so that normal indication is 50% to 75% of full scale deflection.

Completely segregate all instruments in instrument compartments. Panel mount meters on front of instrument compartment.

Provide test link for energy meter testing within instrument compartment.

Provide time switches for load control to BS EN 62054-21

Standards for instruments and meters with interface for communications with controllers. (Refer to scope of works and / or schedules for project particular requirements.)

RS 232C.

BS EN 61968

BS EN 61850

Profibus BS EN 62769

Profinet BS EN 62769

Modbus.

Modbus over Ethernet.

"Wired" interfaces to BS EN 61131-2 (volt-free contacts, relay driven

Communications systems for meters, metering data, metering data exchange:

Pulsed output device to BS EN 62053-31

BS EN 62056

PD CLC/TS 50568-4 and PD CLC/TS 50568-8

BS EN 61968-9 - interfaces for meter reading and control

BS EN 50491-11 - simple external consumer display (smart metering)

Relevant parts of BS EN 13757

2160A ELECTRICAL RECORDING INSTRUMENTS:

Provide electrical recording instruments.
Standard - BS EN 61143.

2171 INDICATOR LIGHTS:

Supply lamps of same type throughout. Provide indicator lamps with lamp test facility. Supply interchangeable indicators for respective units.
For LED indicators, include a voltage suppressor on each LED.

Usage	Lamp Type
Switchboard	LED
Motor control centres	LED

Protect wiring to indicator lamp units by separate cartridge fuses.
Lens Colour in accordance with BS EN 60073.

2176 AUDIBLE ALARMS:

Provide audible alarm system as specified in the Work Section.

2177 PADLOCKS

Provide padlocks and cabinet as specified in Work Section.
Provide each padlock with two keys complete with disc and ring. Engrave disc and padlock with suitable legend.
Provide wall mounted steel cabinet with hinged door for storing padlocks and keys on hooks.

2178 SWITCHBOARD INSTRUMENT AND CONTROL WIRING:

All instrument and control wiring to be either single core insulated cable contained within plastic panel wireway or double insulated cabling installed in a harness.

Identify each end of each wire with a unique number using colour coded 'O' ring markers. Fit lugs at termination points.
All wiring is to be neatly arranged and securely fixed. Where appropriate protect by cartridge fuses complying to BS EN 60269-1, BS 88-1.

2179 MOTOR CONTROL CENTRE, STARTER AND CONTROL PANEL INTERNAL WIRING:

Segregate control wiring from power circuits.
Contain control wiring within plastic wireways or in a harness.
Identify each end of each wire with a unique number using colour coded 'O' ring markers. Fit lugs at termination points.
Take account of thermal effects of grouping when routing power wiring.
All wiring is to be neatly arranged and securely fixed. Where appropriate protect by cartridge fuses complying to BS EN 60269-1, BS 88-1.

2180 LOW VOLTAGE COILS RATING:

Ensure coils for switching relays, contactors and other applications are capable of withstanding inherent voltage drop within system without armature or switching apparatus dropping out of position.

2191 FRAMEWORK:

Construct framework for supporting electrical equipment from mild steel plate and strip, cold and hot rolled steel sections or slotted angles, in accordance with BS EN 10210 and BS 4345 respectively. Comply with BS EN 1011-2 for metal arc welding.
Finish

Frameworks mounted inside building shall have a galvanized finish in accordance with BS EN 10346 or BS EN 10143.

Frameworks mounted outside building shall be hot dip galvanized to BS EN ISO 1461 following fabrication.
Supply cadmium or zinc electroplated bolts, nuts, washers and screws.

2201 FUSES:

Supply cartridge fuse links including fuse carrier, bases and associated components that comply with BS EN 60269-1, BS 88-1, fusing factor category gG, unless otherwise indicated.
Use motor circuit fuses where indicated.

2211 DISTRIBUTION BOARDS:

Comply with BS EN 61439-1 and 61439-2 and BS EN 61439-3, as appropriate. Enclosure to be steel,with hinged lockable cover, internal separation Form 1,degree of protection IP31, unless otherwise indicated. Make fuseboards fully shrouded. Fit each distribution board with an isolating switch, size as shown on the drawings.

Install busbars in same position relative to their fuse carriers or miniature circuit- breakers (MCBs) for each pole. In TPN distribution boards supply neutral busbars with one outgoing terminal for each outgoing circuit. Neutral to be rated as phase conductor.

Provide a multi-terminal earthing bar for circuit protective conductors for both insulated and metal-cased boards, with one terminal for each outgoing circuit. Connect directly to earthing terminal without dependence on exposed conductive parts of enclosure.
Identify each protective device by numbering. Identify each terminal on neutral busbar and earthing bar with its respective protective device.
Provide durable, printed circuit identification chart inside enclosure.

Enclosures finish
Apply high standard finish to enclosure and supporting metalwork. Degrease metal and remove rust prior to applying finish.
Comply with paint manufacturer's recommendations regarding preparation, stoving times, temperatures, mixing of finishes, application and coat thickness.

Finish and colour as Manufacturer's standard unless otherwise stated.
When other than manufacturers standard finish is specified, samples for each type of paint system and for each colour shall be provided.

Provide spare ways, 25% or as indicated. Where specific ratings are indicated incorporate fuses or MCBs, otherwise leave ways blank complete with blanking covers for future additions.

Co-ordination in accordance with BS 7671 (IET Wiring Regulations)

Ensure that the relevant fault current (short-circuit) rating of each switchgear and controlgear assembly is greater than or equal to the maximum prospective fault current at the point of connection to the system.

Ensure that the relevant design current does not exceed the rated current of the assembly, or rated current of a circuit of the associated assembly, taking into account applicable diversity and loading factors.

Ensure that any devices and components are integrated into the assembly in accordance with the relevant parts of BS EN 61439.

Ensure all devices and components are declared suitable according to the assembly manufacturer’s instructions or literature.

2221 CONSUMER UNITS:

Comply with BS EN 61439-3. Supply consumer units with minimum degree of protection in accordance with BS EN 60529, IP31.

Where a consumer unit or similar switchgear is to be installed in a dwelling, ensure that it is constructed from, or installed in an enclosure that completely surrounds it that is constructed from, non-combustible material (metal), in accordance with BS 7671 (IET Wiring Regulations).
Provide fuses or miniature circuit-breakers and means of isolation as indicated.

Enclosures finish

For steel enclosure apply high standard finish to enclosure and supporting metalwork. Degrease metal and remove rust prior to applying finish.

Comply with paint manufacturer's recommendations regarding preparation, stoving times, temperatures, mixing of finishes, application and coat thickness.
Finish and colour as Manufacturer's standard unless otherwise indicated.
When other than manufacturer's standard finish is specified samples for each type of paint system and for each colour shall be provided.

Co-ordination in accordance with BS 7671 (IET Wiring Regulations)
Ensure that the relevant fault current (short-circuit) rating of each switchgear and controlgear assembly is greater than or equal to the maximum prospective fault current at the point of connection to the system.
Ensure that the relevant design current does not exceed the rated current of the assembly, or rated current of a circuit of the associated assembly, taking into account applicable diversity and loading factors.
Ensure that any devices and components are integrated into the assembly in accordance with the relevant parts of BS EN 61439.

2231 MINIATURE CIRCUIT-BREAKERS:
Standard
BS EN 60898-1 or BS EN 60898-2 for protection of AC circuits.
BS EN 60898-2 or BS IEC 60898-3 for protection of DC circuits.
Supply miniature circuit-breakers with voltage and current ratings, type according to instantaneous tripping current, rated braking capacity and frequency as drawings, scope of works or schedules.
Arc fault detection
Miniature circuit-breakers fitted with integral arc fault detection to comply with BS EN 62606.
Ensure devices with integral arc fault detection are placed at the origin of the circuit to be protected.

2235A ARC FAULT DETECTION DEVICE
Supply arc fault detection devices in accordance with BS EN 62606.
Ensure arc fault detection devices are placed at the origin of the circuit to be protected.

2235B COMBINED ARC FAULT DETECTION DEVICE WITH OVERCURRENT PROTECTION
Supply combined arc fault detection with over current operation in accordance with BS EN 62606 and BS EN 60898-1.
Ensure arc fault detection devices are placed at the origin of the circuit to be protected.

2235C COMBINED ARC FAULT DETECTION DEVICE WITH RESIDUAL CURRENT PROTECTION:
Supply combined arc fault detection with residual current operation in accordance with BS EN 62606 and either BS EN 61008-1 or BS EN 62423 as appropriate.
Ensure arc fault detection devices are placed at the origin of the circuit to be protected.
Select the residual current detection Type (AC, A, B or F) in accordance with BS 7671 (IET Wiring Regulations).

2235D COMBINED ARC FAULT DETECTION DEVICE WITH OVERCURRENT AND RESIDUAL CURRENT PROTECTION:
Supply combined arc fault detection with residual current/overcurrent operation in accordance with BS EN 62606 and either BS EN 61009-1, or BS EN 60898-1 plus either BS EN 61008-1 or BS EN 62423.
Ensure arc fault detection devices are placed at the origin of the circuit to be protected.
Select the residual current detection Type (AC, A, B or F) in accordance with BS 7671 (IET Wiring Regulations).

2241 RESIDUAL CURRENT DEVICE:
Comply with BS EN 61008 or BS EN 62423. Supply residual current circuit breakers (RCCBs) with rated voltage, rated current, rated tripping current, rated tripping time and rated breaking capacity as indicated.
DC component
Ensure DC component does not affect operation by selecting the residual current detection Type (AC, A, B or F) in accordance with BS 7671 (IET Wiring Regulations).
Rated Tripping Current
30mA unless otherwise indicated on the drawings.
Rated Tripping Time
30ms unless otherwise indicated on the drawings.

Fit with integral over current protection as detailed on drawings or schedules.
Refrigerators and deep freezers should not be connected to RCCB Protected Circuits unless written confirmation is obtained.

Supply combined residual current/over current operated circuit-breakers (RCBOs) to BS EN 61009

Where, as indicated on the drawings or schedules, RCDs are fitted with integral arc fault detection to BS EN 62606, ensure devices are placed at the origin of the circuit to be protected.

2242 RESIDUAL CURRENT MONITORS
Standard - BS EN 62020 IEC62020

2247 AUTOMATIC RECLOSING DEVICES FOR CIRCUIT BREAKERS AND RESIDUAL CURRENT OPERATED CIRCUIT BREAKERS WITH OR WITHOUT OVERCURRENT PROTECTION:
Where detailed in the scope of works or scheduled / indicated on the drawings, supply automatic reclosing devices (ARDs) for circuit breakers, residual current devices with overcurrent protection (RCBOs) and residual current circuit breakers (RCCBs) in accordance with BS EN 63024
Ensure automatic reclosing devices are only installed on devices protecting parts of the installation where access is restricted to instructed persons or skilled persons as defined in BS 7671 (IET Wiring Regulations).
Ensure a suitable warning notice is displayed near the points of access to parts of the installation controlled by automatic closing devices

2250 CABLE TERMINATIONS:
Ensure that switchgear and distribution boards are provided with facilities to terminate size, number and type of cable indicated. Where necessary use fabricated steel extension boxes for glanding large and multiple cables.
Provide non-ferrous metal glanding plates for single core cable terminations.

2251 TERMINAL BLOCKS FOR AUXILIARY WIRING:
Provide rail mounted moulded terminal blocks with fully shrouded connectors, segregation plates, and end clamps. Ensure insulating material is suitable for maximum operating temperature of conductors.
Provide connectors to clamp conductors between metal surfaces. Ensure clamping screws do not make direct contact with conductors. Ensure conductors maintain sufficient contact pressure to ensure negligible impedance. Make metal in contact with conductors 85% copper alloy and screws of metal electrolytically compatible with copper alloy.
Provide each terminal with marking tag fitted into moulded tag slots.
Provide test probe facilities and integral disconnecting device to facilitate testing on terminals for indication, instrumentation and metering.
Manufacture rails from steel, hot dipped galvanised after manufacture.

2252 COMPONENT MOUNTING:
Mount all components on removable back plates. Ensure no fixings protrude into busbar chamber.

2261 / 2271 STATIC CAPACITOR / AUTOMATICALLY CONTROLLED CAPACITOR BANKS:
Refer to schedules for details of when / where required.
Standards
BS EN 61921 and the following to suit the application.
BS EN 60143.
BS EN 60831.
BS EN 60871.
BS EN 60931.
BS EN 60110-1
Voltage rating of capacitor - 400V, 3-phase, 50 Hz.
Mounting – as detailed in schedules or scope of works.
Capacitor unit
Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
Capacitor unit assembly
Incorporate thermal equalizers within assembly of elements.

Fill enclosure with inorganic, inert and non-flammable granules.
Fit discharge resistors.
Ensure all internal and external connections are adequately rated and fully insulated.
Automatic bank enclosure - Manufacturer's standard.

2281 HARMONIC FILTER:
Refer to schedules for details of when / where required.
Unit - Filter conditioning to meet G5/4.
Mounting - Floor mounting. Built-in type.
Cubicle - Incorporating IGBTs, capacitors, reactors, block contactors and control gear.
Cable termination chamber - Mount cable termination chamber on side of cubicle with access through removable plates.

2291 MEDIUM VOLTAGE IRON CORE FILTER REACTOR:
Refer to schedules for details of when / where required.
Provide 3-phase filter reactor in accordance with BS EN 60076 and relevant parts of BS EN 61558
Reactor
Copper foil windings insulated between layers, impregnated under vacuum and in over pressure conditions with polyester resin and dried in furnace temperature of 150°C.
Ensure iron core flux density is designed for indicated harmonic loading. Ensure that saturation does not occur at switch-in of filter network.
Provide insulation for continuous operation at ambient temperature up to 40°C, temperature class T40/E.
Electrical connections - to copper bars in accordance with DIN 46206.

2301 SWITCHGEAR AND CONTROL GEAR ACCESSORIES
Provide switchgear and controlgear accessories as indicated. Provide insulating mats along the operating length of each switchboard of minimum width 1,000mm. Provide all switchgear operating tools required for each switchboard. Provide 10% of the number of each size of fuses used as spare.

3000 WORKMANSHIP

3010 FIXING:
Fix all equipment independently of wiring system. Use cadmium or zinc electroplated bolts, nuts, washers and screws.

3021 MOUNTING HEIGHT:
Mount single items of equipment 1450mm above finished floor level to centre of equipment, unless otherwise indicated.

Arrange groups of equipment, other than floor mounted assemblies, so that all parts of equipment requiring access for operation or maintenance are at least 500mm and no more than 2000mm above finished floor level (max height of operating handles 1800mm), unless otherwise indicated.

3030 ACCESS:
Ensure that clearance in front of switchgear and controlgear is not less than 1m, or as indicated.

3031 ACCESS TO CONTROL COMPONENTS:
Arrange control components to ensure adequate access for operation and maintenance.

3032 ANCILLARIES:
Install ancillaries in accordance with manufacturer's instructions.

3041 MARKING:
Number terminals, cables and component parts to correspond with manufacturers certified drawings.

3051 CABLE TERMINATIONS:

Terminate paper-insulated cable by means of switchboard manufacturer's standard compound filled cable boxes.
Terminate PVC,XLPE and MICC cables inside enclosure by securing cables to switchboard with glanding plates or glanding brackets; and outside enclosure with glanding plates or fabricated steel extension boxes.
Provide cable support systems within the switchboards between cable entry point and connection to respective devices. Where multicore cables are glanded at a distance from device connection points the inner cable sheath should be maintained and supported and fixed within the switchboard.

3061 INSTALLATION AND COMMISSIONING:
Install and commission switchgear and controlgear in accordance with the appropriate standard and the manufacturers' recommendations. Include CT Polarity check in commissioning tests.
Commissioning of all equipment to be carried out by relevantly qualified specialist personnel.

10000 NES VERSION Y71 TEXT Dec 19

10111011 ELECTRICAL SUPPLY:
Ensure all electrical equipment supplied and installed is suitable for power supply indicated.

1041 CONTROL DETAILS
Control details for electrical switchboards are in Work Section V20 and for mechanical controls in Work Section W60 which must be read for details on control philosophy.

2000 PRODUCTS/MATERIALS

2010A CONTROLGEAR ASSEMBLY / LV SWITCHGEAR & COMPONENTS GENERALLY:

Standards - BS EN 61439-1, BS EN 61439-2, relevant parts of BS EN 60947 and BS EN 62626-1 for enclosed switch-disconnectors outside the scope of IEC 60947-3 to provide isolation during repair and maintenance work.

Usage - Control panel, Motor Control Centre (MCC) or single starter enclosure.

Conditions of installation - Indoors.

Electrical characteristics

Rated operational voltage, 400 V. Rated short-time withstand current, 20 times rated current.

Service conditions - Ambient air temperature and altitude to relevant parts of BS EN 61439.

EMC-Environment A - Light Industrial/Commercial

Co-ordination in accordance with BS 7671 (IET Wiring Regulations)

Ensure that the relevant fault current (short-circuit) rating of each switchgear and controlgear assembly is greater than or equal to the maximum prospective fault current at the point of connection to the system.

Ensure that the relevant design current does not exceed the rated current of the assembly, or rated current of a circuit of the associated assembly, taking into account applicable diversity and loading factors.

Ensure that any devices and components are integrated into the assembly in accordance with the relevant parts of BS EN 61439.

2021 ENCLOSURES:

For control equipment remote from MCC and not a package unit.

Standards

Enclosure standard BS EN 62208

Relevant parts of BS EN 61439

Mounting rails BS EN 60715

Material

Metal clad or

Impact resistant moulded plastic.

Degree of protection - BS EN 60529,

IP 31 for units installed inside buildings.

IP 55 for units installed in wet plant rooms (boiler / heating rooms, chiller rooms, pump rooms, water services rooms, air handling rooms with water systems etc).

IP 54 for units installed in ventilation / dry plant rooms.

IP 65 for units installed externally.

Finish and colour to Manufacturers standard unless otherwise stated.

2051 LV CONTACTORS AND MOTOR STARTERS:

Application: Mechanical plant control

Standards

BS EN 60947-4-1 and -4-2.

Solid state to BS 5424-2.

BS EN 61095.

BS EN 62626-1

Type of contactor

Air break.

Classification

Electromagnetic.

Rated operational voltage,current and poles to suit application.

Uninterrupted duty.

Utilization category (ac contactors)

AC3 for Direct-on-Line, Star Delta, Auto Transformer Starters.

AC4 for Direct-on-Line, Reversing Starter.

IP rating option

Enclosure degree of protection to BS EN 60529, IP 31, or IP 65 where BS EN 62626-1 applies.

Operational Performance not less that Table 10 of BSEN 60947-4-1

Mechanical durability 3 million no-load operations

2052 COIL POWER SUPPLY:

Contactor closing coil power supply:-

To match control operating voltage.

2053 AUXILIARY CIRCUIT CONTACTS:

Application to match specific control requirements.

Utilization category

AC15 for ac circuits to BS EN 60947-5-1.

DC13 for dc circuits to BS EN 60947-5-1.

Ensure mechanical and electrical endurances compatible with contactor.

2054 CO-ORDINATION WITH SHORT CIRCUIT PROTECTION DEVICES:

Provide co-ordination to Type `2' of BS EN 60947-4-1.

Unless otherwise indicated supply cartridge fuse links including fuse carrier, bases and associated components that comply with BS 88, utilisation category 'gC'.

Provide verification of co-ordination with short circuit protection devices.

2061 CONTROL CIRCUIT DEVICES

Standard – comply with BS EN 60947-5-1 for electromechanical control circuit devices including

Manual control switches; emergency stop; control relays; pilot switches; position switches; associated equipment; auxiliary contacts and indicating lamps.

2071 IN-BUILT ISOLATING SWITCHES/DISCONNECTERS:

Standard-BS EN 60947-3 or BS EN 60947-2 (MCCB) or BS EN 62626-1.

Provide independent manual operation with rated operational current and utilization category compatible with contactor.

Ensure drive disconnector isolates all circuits including those from external sources prior to allowing access to the interior of enclosure.

2081 IN-BUILT CONTROL SELECTOR SWITCHES:

Standard-BS EN 60947-5-1, BS EN 62626-1

Provide panel mounting independent manual operation rotary type switch to

select local/off/remote control.

and to match specified plant control requirements.

Ensure switch rated thermal current, rated operational current, and utilization category are compatible with contactor control circuit characteristics and circuit protection device.

2091 IN-BUILT PUSH BUTTONS:

Standard BS EN 60947-5-1

Provide panel mounting type push buttons with actuator colours to BS EN 60073 to suit application and as specified.

Ensure rated thermal current, rated operational current and utilization category of push button contacts are compatible with contactor control circuit characteristics and circuit protection device.

Emergency Stop buttons to incorporate mushroom actuator and require positive resetting action by key unless otherwise indicated.

2101 INDICATOR LIGHTS:

Supply lamps of same type throughout. Provide indicator lamps with lamp test facility. Supply interchangeable indicators for respective units.

Standard-BS EN 842 and BS EN 60947-5-1

For LED indicators, include a voltage suppressor on each LED.

Usage	Lamp Type
Switchboard	LED
Motor control centres	LED

Protect wiring to indicator lamp units by separate cartridge fuses.

Lens Colour in accordance with BS EN 60073.

2111 CONTACTOR CONTROL RELAYS:

Standard-BS EN 60947-5-1

Install relays in contactor enclosure or install relays in separate enclosures and interconnect relays with contactor control circuits as detailed.
Relay enclosure protection to BS EN 60529 compatible with contactor enclosure.

2121 CONTROL AND INDICATOR LIGHT CIRCUIT FUSES:

Provide in contactor enclosure separate low voltage fuse bases, fuse carriers and cartridge fuses for protection of control circuits and indicator light circuits.
Fuses

Fully shrouded impact resistant moulded plastic fuse bases and carriers in accordance with BS EN 60269, BS 88. Supply category gG cartridge fuses to BS EN 60269, BS 88 unless otherwise indicated.
Fuse-holders for miniature fuse-links to BS EN 60127-6.
Cartridge fuses (miniature fuses) in accordance with BS EN 60127-2.

2131 MOTOR STARTERS / VSD's- GENERAL:

Provide VSD's as scheduled or detailed in the project specific scope of works.
Provide fuses or circuit breakers for motors below 0.37 kW.
Provide starters incorporating over current protection for motors above 0.37kW and below 37 kW
Provide isolation during repair and maintenance work in accordance with BS EN 62626-1.
Provide starter with manual reset, adjustable, inverse time delay, and ambient temperature compensated thermal over current release to BS EN 60947-4-1. Ensure over current release is compatible with starting, accelerating and running characteristics of motor, starter and driven machine combination. Use phase unbalance protection on three phase equipment.

Provide starters incorporating solid state motor protection above 37kW and below 75 kW or as otherwise indicated.

Provide starters incorporating over current protection for motors above 75 kW
Provide starter with sensitive discriminating thermal magnetic over current relay with precise time/current characteristics to BS EN 61810. Protect motor against effects of sustained and cyclic over current, out of balance phase current, stalled condition and earth faults. Use running load indication type over current relays with accuracy of setting and indication within plus or minus 3 per cent, expressed as a percentage of setting indicated.

Unless detailed otherwise in the scope of works or schedules the type of starters or VSD's shall be dependent on the size of the motor, see table below. See Work Section or Schedules for particular requirements.

MOTOR STARTING METHOD	No starters	Direct On Line	Star-delta	Soft Start	VSD (Inverter)	Assisted start (auto transformer/ assisted start)
MOTOR SIZE RANGE & TYPE	Below 0.37kW	0.37-7.5kW	7.5-30kW	7.5-400kW	All sizes where speed control is required as described in the scope of works plant / equipment schedules or schedules W60sch1 or 2	As indicated

2141 MOTOR STARTERS - CURRENT LIMITING TYPE (SOFT START):

Use static type thyristor voltage control starter to provide reduced current starting. Not exceeding 1 x FLC.

Provide energy saving units where indicated.
Provide adjustable ramp times.
Provide contactor for switching and disconnector for isolation.
Provide details of harmonic distortion content prior to ordering.
Provide isolation during repair and maintenance work in accordance with BS EN 62626-1

2150 MOTOR STARTERS - DIRECT-ON-LINE TYPE:

Use direct-on-line starter to BS EN 60947-4-1, with single phase motors and three phase motors.
Provide isolation during repair and maintenance work in accordance with BS EN 62626-1

2161 MOTOR STARTERS - STAR DELTA TYPE:

Use star delta starter to BS EN 60947-4-1 with three phase motors.
Incorporate adjustable time delay contactor relays, to control star delta changeover, ensuring electrical endurance compatible with starter contactors. Ensure starting sequence activated on voltage restoration.
Provide isolation during repair and maintenance work in accordance with BS EN 62626-1
Where star-delta starters are used on motor sizes in excess of 30kW, 'closed transition' type starters shall be employed.

2170 MOTOR STARTERS - AUTO-TRANSFORMER TYPE:

Use auto-transformer starter to BS EN 60947-4-1 with three phase motors.
Provide 2 step closed transition auto transformers suitable for 3 operating cycles per hour.
Provide isolation during repair and maintenance work in accordance with BS EN 62626-1
Provide auto transformers with three tappings for selection of motor starting voltage. Arrange tappings to limit motor starting current to 80 per cent, 65 per cent and 50 per cent of full voltage starting current.
Incorporate adjustable time delay contactor relays, to control automatic changeover from selected reduced voltage to full voltage, having an electrical endurance compatible with starter contactors. Ensure starting sequence activated on voltage restoration.

2180 MOTOR STARTERS - STATOR ROTOR TYPE:

Use stator rotor starter to BS EN 60947-4-1 with three phase motors.
Provide starter resistors suitable for indicated operating cycles per hour.
Provide isolation during repair and maintenance work in accordance with BS EN 62626-1.
Incorporate adjustable time delay contactor relays, to control starter resistor short circuiting contactors, having electrical endurance compatible with starter contactors. Ensure starting sequence activated on voltage restoration.

2191 VARIABLE SPEED MOTOR DRIVES (VSD'S)

Also refer to clause Y92 2085 and plant schedules.
Standards
- Comply with relevant parts of BS EN 60204 for safety of electrical equipment.
- Comply with relevant parts of BS EN 61800
- Comply with relevant parts of BS EN 60068 for environmental testing.

Harmonics
- Comply with BS EN 61000-3-12

Incorporate facilities into the drive to minimise harmonics generated at partial loads to ENA Engineering recommendation G5/4-1 limits.

Supply VSD tailor made for HVAC application with two built in PID controllers, built in HVAC application macros and real-time clock to control speed of standard AC Squirrel cage motors.
Type - Digital PWM, unless specified otherwise, 6 pulse inverters may be used for motor ratings up to and including 35kW with 6 pulse rectifiers used for motor ratings greater than 35kW.
Where a variable speed drive is integrated with a pump or fan it shall be isolated from any vibration from the pump / motor and have a life expectancy no shorter than the motor life expectancy.

For locations and mounting – refer to Work Section W60, scope of works or plant / equipment schedules when the VSD is part of the packaged plant or supplied by the plant manufacturer.

Control range 0.5 to 120 Hz.
Power factor – 0.97 lagging or better
Starting current not to exceed 1 x FLC.
Degree of protection from drive enclosure in accordance with BS EN 60529 to be as detailed in particular specification. If this is not detailed in the particular specification provide:
- IP 55 for units installed in wet plant rooms (boiler / heating rooms, chiller rooms, pump rooms, water services rooms, where water jets could occur).
- IP 54 for units installed in other plant rooms eg ventilation plant rooms where only splashing water could occur
- IP 21 for units incorporated with enclosures / control panels.

Characteristics

Ensure acceleration and deceleration ramps are independently adjustable.
Allow connection to a turning motor without braking to a standstill.
Allow connection to a reverse wind milling fan without causing tripping and return fan to correct speed.
Ensure inverters require no additional means for starting.
Supply inverters that do not require electrical matching to motor.
Ensure inverters are capable of running motors in parallel.
Ensure electronic maintenance and commissioning can be carried out without motor being connected.
EMC characteristics to BS EN 61800-3, class C2.

Mains interruption

Ensure inverter does not cause tripping through a mains interruption of
200 msec unless otherwise indicated.

Protection

Ensure inverter incorporates the following protection to cause electronic shut down without operating circuit protective devices.

Motor phase to phase fault.
Motor phase to earth fault.
Over voltage.
Under voltage.
Inverter overheat.
Motor overheat.
Stall protection.
Loss of control signal.
Loss of auxiliary control voltage.
Current limit.
Overcurrent protection.
Phase loss detection.
Underload supervision.
Overload supervision.

VSD controls

Local/remote facility to be provided where appropriate for operational and maintenance use.
Provide a means of running at a fixed, selectable speed on closure of a remote volt free contact.
Ensure this over-rides the normal speed control reference signal.

Display

Make provision for inverter to display externally, external and internal faults following a failure.
Show 1st, 2nd and 3rd up sequential faults.
Provide digital readout to show

Output frequency Hz.
Reference 1 (Hand).
Reference 2 (Auto).
Motor current (% or Amps).
Torque (% x PN).
DC Link voltage (%).
Temperature (°C).
Fault memory.

Provide volt free remote signalling contacts to indicate:

Over current.
Frequency alarm.
Common fault.
Reference fail alarm.
Running/stopped conditions.
Healthy/tripped conditions.

Ensure parameters can be set and fault memory interrogated with door closed, and without additional instrumentation.

Cooling

Ensure the free space around the drive is in accordance with the manufacturer's recommendations for ventilation and maintenance.

When installing a VSD in a control panel cabinet or MCC, provide ventilation openings and if required cooling fans in the cabinet to ensure air cannot be recirculated such that the cooling air does not exceed the unit ambient maximum operating temperature.

Provide isolation during repair and maintenance work in accordance with BS EN 62626-1

2201 AUTOMATIC CHANGEOVER FOR RUN/STANDBY DUTY:

Provide paired contactors incorporating mechanical and electrical interlocks to prevent simultaneous closure to meet the control requirements Work Section W60

Fit a rotary control switch to starter enclosure arranged to select either motor for 'run' or 'standby' duty. Indicate selection of respective motor and over current tripping of motors by illumination of indicator lights on starter enclosure.

Provide facilities for connection of remote indicator lights to indicate selection/operation of system and for connection of a system malfunction alarm, as indicated.

Arrange for selected 'run' duty motor to operate in response to system controls, and in event of operation of duty motor starter over current trip, for automatic changeover to 'standby' motor.

Control power supply to contactors by an air- break isolating switch interlocked with enclosure access door. Where dual power supplies are available ensure isolating switch disconnects both supplies and indicate presence of either supply.

2221 CONTROL CIRCUIT POWER SUPPLIES /TRANSFORMERS:

Provide control circuit transformers to supply power at voltages to suit control components.

Standard

Use transformers in accordance with BS EN IEC 61558-1 and either BS EN 61558-2-2 or BS EN 61558-2-6 and provide an external label of approved type and size.

Protection - primary and secondary fuses.

2231 SWITCHING AND INDICATION:

Provide switches, indicating lamps, instruments and controls of uniform appearance and physically protected.

Switches and indicators to be fitted on panel or access doors and unless otherwise indicated shall be:

Motor circuit isolating switches.
Stop/Start/Reset push buttons.
Auto/Off/Manual control selector switch.
Run and trip indicator lights.

2241 AUDIBLE ALARMS:

Provide audible alarm system as specified in Work Section.

2251 (PROGRAMMABLE LOGIC CONTROLLERS):

Provide programmable logic controllers in accordance with BS EN 61131, the manufacturer's recommendation and the specified control requirements. Provide an isolator for the Programmable Logic controller. Programming language standard - BE EN 61131. Install PLC in separate compartment with viewing window.

Control system communications to BS EN 61158-2.

2261 STARTER AND CONTROL PANEL INTERNAL WIRING:

Standards

BS 6231 for polyvinyl chloride (PVC) tri-rated switchgear cable
BS EN 50525-3-41 for Low Smoke Zero Halogen (LSZH) cable

Wiring coding, selection, installation and termination to BS EN 60445, BS EN 61439-series, BS EN 60204-1 and BS 7671, as relevant.

Ensure dedicated telecommunications functional earth conductors are identified, and labelled 'TELECOMMS FUNCTIONAL EARTH' in accordance with BS 6701.

Ensure combined protective earthing and functional earthing conductors are identified as protective conductors.

Control wiring

Segregate control and auxiliary contact wiring from power circuits. Contain control wiring in slotted plastic trunking.

Provide electrical separation for voltages of different bands in accordance with BS 7671, BS EN 60204-1 and BS EN 61439-series as relevant.

Power wiring

Take account of thermal effects of grouping when routing power wiring.

All wires

Identify each end of each wire with a unique wire number according to the control panel drawings and cable schedule.

Terminate wiring intended for screw terminals with ferrules to facilitate fault-finding and maintenance replacement.

2271 COMPONENT MOUNTING:

Mount all components of the switchgear and controlgear in accordance with the manufacturer's instructions. Mount control components on removable back plates.

2281 CONTROL SYSTEM FUNCTION CHARTS

Prepare function charts for the control system in accordance with BS EN 60848. Obtain approval of function chart before design of system hardware or writing control software.

Function chart format - Combined function chart/circuit diagram.

3000 WORKMANSHIP

3011 INSTALLATION:

Install contactors, starters, VSD’s and control panels / MCC’s in accordance with relevant parts of BS EN 60947 and manufacturer's recommendations.

10000 NES VERSION Y72 TEXT Dec 18

Incorporates clauses from V41 – Street/area/flood lighting & some stds in NES V21

1000 GENERAL

Lamps and related equipment to comply with EU Regulation 2015/1428 with regard to ecodesign requirements.

1010 STANDARDS:

Supply luminaires and lamps as indicated to standards as appropriate.

1011 BUILDING REGULATIONS

The contractor shall ensure that all luminaires comply with the Building Regulations (Part B2 section 6) with respect to their fire retardant properties, in the configuration indicated on the drawings.

1012 PARTICULAR REQUIREMENTS

Provide luminaires as indicated in the Schedules and/or drawings.

2000 PRODUCTS/MATERIALS

2011 LUMINAIRES:

Standards

Supply luminaires with photometric data in accordance with relevant parts of BS EN 13032.

Ensure luminaires of similar type have same photometric performance as published data within the tolerances defined by the standard.

Supply luminaires with performance in accordance with:

BS EN 62722-1 in general.

BS EN 62722-2-1 for LED luminaires.

BS EN 62922 for organic LED (OLED) panels.

Supply luminaires in accordance with relevant parts of BS EN 60598 and BS 4533 where still current as below: (Luminaires with type “n” protection to comply with BS EN 60079-15 and BS EN IEC 60079-7)

- Fixed general purpose luminaires to BS 4533 Section 102.1 (BS EN 60598-2-1).
- Recessed luminaires to BS EN 60598-2-2.
- Luminaires for road and street lighting to BS 5489-1 and BS EN 60598-2-3. Photoelectric controller to BS 5972
- Floodlights to BS EN 60598-2-5, N Protection to BS 4533 Section 102.51. Floodlight towers steel structures to BS EN 1993-3-1
- Luminaires with built-in transformers for filament lamps to BS EN 60598-2-6
- Ground recessed luminaires to BS EN 60598-2-13.
- Luminaires for swimming pools and similar applications to BS EN 60598-2-18.
- Air-handling luminaires to BS 4533 Section 102.19 (BS EN 60598-2-19).
- Luminaires for hospitals and health care buildings to BS EN 60598-2-25.
- Electrical supply track systems for luminaires to BS EN 60570.
- ELV lighting systems for filament lamps to BS EN 60598-2-23
- Luminaires with limited surface temperature to BS EN 60598-2-24
- LED modules for general lighting to BS EN 62031 and BS EN 62717
- Transilluminated traffic bollards to BS EN 12899-2
- Lighting strings / chains to BS EN 60598-2-20.
- Rope lights to BS EN 60598-2-21.
- Luminaires for stage lighting, television and film studios to BS EN IEC 60598-2-17
- Presentation of data for luminaires used for road lighting to be in accordance with BS EN 13032-5

General requirements and tests / classification BS EN 60598-1 as indicated.

Safety

Fit luminaire with cover glass to protect against ultra-violet emission and risk from explosion of lamps where scheduled.

Ensure ground recessed luminaires are selected and installed in accordance with the guidance provided in Table A.1 of BS EN 60598-2-1, with respect to their location and intended application.

Safety support for Components - Provide secondary support for translucent covers, diffusers and gear trays so they are prevented from falling when their primary fixing is released.

Electromagnetic Compatibility- Ensure luminaires comply with BS EN 61547 for EMC immunity.

Comply with relevant parts of BS EN 61995 for devices for the connection of luminaires.

2021 EMERGENCY LIGHTING LUMINAIRES:

Comply with BS EN 60598-2-22.

Comply with ICEL:1001. Ensure emergency lighting luminaires are marked with ICEL certification label.

2030 EXIT SIGNS:
Comply with 5499-4.

2041 HAZARDOUS AREA LUMINAIRES:
Standards as appropriate :
BS EN IEC 60079 series / BS EN 60079-0, BS EN 60079-1, BS EN 60079-5, BS EN 60079-6, BS EN 60079-11, BS EN 60079-14 BS EN 60079-15, BS EN 60079-25.

2050 SIGNS & HIGH VOLTAGE INSTALLATIONS:
Standard
Comply with BS 559 and BS EN 50107-1.
Neon transformers
Supply transformers for tubular discharge lamps with no-load output voltage exceeding 1000 V in accordance with BS EN 61050.
Secondary protection to BS EN 50107-2.

2055 OPTICAL FIBRE LUMINAIRES
Where indicated provide optical fibre luminaires.
Optical fibre connection to BS EN ISO 11149.

2057 LED LUMINAIRES:
Standards
Supply luminaires with photometric data in accordance with relevant parts of BS EN 13032
Supply luminaires in accordance with BS EN 60598
Supply luminaires with performance in accordance with BS EN 62722-1 and BS EN 62722-2-1
Classification to BS EN 60598-1
Safety support for components
Provide secondary support for translucent covers, diffusers and gear trays so they are prevented from falling when their primary fixing is released.
Photometric performance
Ensure luminaires of similar type have same photometric performance as published data within the tolerances defined by BS EN 13032-1
Electromagnetic compatibility
Ensure luminaires comply with BS EN 61547 for EMC immunity.

2061 LAMPHOLDERS - GENERALLY:
Standards
Ensure lampholders are suitable for use with corresponding lamp caps to - BS EN 60061-1.
Lamp holders - BS EN 60061-2. Enhanced safety type BS 7895.
Bayonet lampholders - BS EN 61184.
Lampholders for tubular fluorescent lamps and starter holders - BS EN 60400.
Edison screw lampholders - BS EN IEC 60238.
Lampholders of miscellaneous types for building-in (e.g. projection lamps, floodlighting lamps etc) - relevant parts of BS EN 60838

Interchangeability - Ensure lampholders in luminaires of similar type and rating are identical.
Earthing - Ensure metal lampholders incorporate an earthing terminal.
Material - When plastic is used in the lampholder it shall be heat resistant moulded plastic.

2080 LAMPHOLDERS - MOUNTING:
Securely mount lampholder in luminaire when it is sole support for lamp.
Cord grip - provide integral cord grip type when lampholders are suspended by cord.
Conduit Mounted - when mounted directly to conduit system use backplate lampholder for conduit box.

2090 CONTROL GEAR AND COMPONENTS
Comply with all parts of BS EN 61347 / BS EN IEC 61347
Compatibility

Ensure control gear and components are suitable for lamp type, wattage, starting characteristics, and luminaire environment.

Obtain from manufacturers written confirmation of compatibility.

Efficiency tested in accordance with the relevant parts of BS EN IEC 62442 to suit lamp type selected.

Lighting control interface for dimming (Analogue voltage dimming interface for electronic current sourcing control gear) to BS EN IEC 63128

2101 FLUORESCENT LAMP BALLASTS AND STARTERS:

Standard

Ballasts

BS EN 61347-2-8 and BS EN 60921 for fluorescent lamps.

BS EN 61347-2-3 & 2-7and BS EN 60929 for DC supplied electronic ballasts.

BS EN 61347-2-3 and BS EN 60929 for fluorescent lamps and high frequencies.

Supply thermal protectors for ballasts for tubular fluorescent lamps to BS EN 60730-2-3.

Starters

BS EN 61347-2-1 and BS EN 60927 for starters other than glow switch.

BS EN 60155 for glow switch starters.

Use low distortion type.

2110 DISCHARGE LAMP BALLASTS AND STARTERS:

Standard

Ballasts - BS EN 61347-2-9 and BS EN 60923.

Starters - BS EN 61347-2-1 and BS EN 60927.

2115 LED MODULE CONTROL GEAR:

Provide LED module control gear to BS EN 61347-2-13 and BS EN 62384.

2120 CAPACITORS:

Use capacitors in accordance with BS EN 61048 and BS EN 61049 in tubular fluorescent, high pressure mercury and low pressure sodium vapour discharge lamp circuits.

2130 SUPPLY TERMINALS:

Use screw terminals for supply cables and circuit protective conductors, sized to terminate up to three 2.5mm2 conductors. Provide separate terminal blocks for each incoming circuit, with marking to identify each circuit.

2141 FUSE:

Include a fuse holder and BS 1362 fuse in each incoming circuit phase connection for fluorescent and discharge luminaires.

2150 INTERFERENCE:

Comply with BS EN 55015 .

2160 REMOTE GEAR:

Locate control gear in separate lockable cabinet of sheet steel with same degree of protection and finish specified for luminaire. Comply with manufacturer's recommendations for cable type and maximum length between gear and lamp.

2180 FLUORESCENT LAMPS:

Standard

Internationally specified tubular fluorescent lamps to BS EN 60081.

UK tubular fluorescent lamps to BS 1853-2 not included in BS EN 60081, BS EN 60901, BS EN 61195 and BS EN 61199.

Single capped fluorescent lamps to BS EN 60901(performance) and BS EN 61199 (safety)

Double capped fluorescent lamps to BS EN 61195 (safety) and BS EN 60081 (performance).

Self-ballasted lamps to BS EN 60969 and BS EN 60968 for safety requirements.

2182 FLUORESCENT INDUCTION LAMPS:

Comply with BS EN 62532

2185 TUNGSTEN HALOGEN LAMPS
Comply with BS EN 60357, BS EN 60432-2.

2190 HIGH PRESSURE MERCURY VAPOUR LAMPS:
Comply with BS EN 60188 and BS EN 62035 for safety specifications

2192 METAL HALIDE LAMPS:
Comply with BS EN 61167 and BS EN 62035 for safety specifications

2200 HIGH PRESSURE SODIUM VAPOUR LAMPS:
Comply with BS EN 60662 and BS EN 62035 for safety specifications

2210 LOW PRESSURE SODIUM VAPOUR LAMPS:
Comply with BS EN 60192 and BS EN 62035 for safety specifications

2215 LED LAMPS / MODULES:
Standards
BS EN 50564 for measurement of low power consumption.
BS EN 62031 for measurement of low power consumption.
BS EN 62612 for performance requirements and BS EN 62560 for safety specifications - self-ballasted LED lamps, for supply voltages > 50 V.
BS EN 62838 for LEDsi lamps with supply voltage not exceeding AC 50 V or ripple-free DC 120 V.
BS EN 62868 and BS EN 62922 for Organic LED (OLED) panels.

LED modules control gear
BS EN 62717 for performance requirements
BS EN 62031 for safety requirements
BS EN IEC 62386-207 for digital addressable lighting interface (DALI) control gear.
BS EN 61347-2-13 and BS EN 62384 for control gear.

2221 TRANSFORMERS FOR LV LUMINAIRES
Standards; relevant parts of BS EN 55014, BS EN 61000, BS EN 61047. BS EN 61347-2-2, BS EN 61558 .
Provide electronic or wound type as specified. Provide secondary fuse or thermal cut-out with automatic reset.

2230 LAMP MANUFACTURER:
Ensure that lamps of each type are from same manufacturer.

2241 SUPPORT SYSTEM - CONDUIT/TRUNKING:
Use not less than 20mm conduit of same type as main conduit system. Trunking type and size as indicated on drawings.

2251 SUPPORT SYSTEM - ROD:
Use continuously threaded rods with matching washers and nuts, minimum 6mm diameter and a carrying capacity of not less than twice the weight of the complete luminaire. Material, Cadmium plated steel unless otherwise indicated.

2260 SUPPORT SYSTEM - CHAIN:
Use cadmium plated steel chain with load carrying capacity of not less than twice weight of complete luminaire.

2271 SUPPORT SYSTEM -FLEXIBLE CORD:
Use size and type as appropriate. Confirm temperature rating is suitable for operating temperature of luminaire or lampholder. Confirm that cord is adequate for mass to be supported.

2280 SUPPORT SYSTEM - WALL BRACKETS:
Provide wall brackets. Confirm wall brackets are suitable for supporting luminaire.

2290 SUPPORT SYSTEM - BALL AND SOCKET:
Provide ball and socket as top support, complete with cover fixed to circular conduit box.

2295 SUPPORT SYSTEM – WIRE ROPE
Standards BS EN 12385-1, BS EN 13411-3, BS EN 13411-4, and BSRIA COP 22/2002
Use proprietary Wire Rope Suspensions Systems comprising of stainless steel components.

2301 COLUMNS AND BOLLARDS:
Standards
BS EN 40-2, BS EN 40-5, BS EN 40-6, BS EN 40-7 and BS EN 12767
Material, finish, height and lamp as specified in Work Section or on drawings.
Applied loads-Supply columns designed for additional externally applied loads 3 times luminaire mass.
Cutout and fuses to BS 7654 -Provide cut-out fuses and cable termination within accessible, lockable services enclosure.
Earthing-Include earthing terminal fixed within service enclosure.
Column base plate-Manufacturers standard.

2305 LIGHTING COLUMN/BOLLARD SWITCHGEAR:
Comply with the following unless detailed otherwise in the schedules or scope of works.
Service compartment
Standards
BS EN 40-2 for general requirements of lighting columns
BS 7671
Accessible only by use of a key or tool
Rating to BS EN 60529 - IP44.
Switchgear and circuit protection
Enclosure
Standard BS EN 61439
IP Rating to BS EN 60529 - Drip-proof to a minimum of IP31.
Circuit protective devices/Isolators
Standard
BS EN 60898
BS EN 61008
BS EN 61009
BS EN 60269, BS 88
BS EN 60947
Means of isolation
Double-pole isolator switch with key-lockable lock off facility or Double-pole mcb or RCBO with key-lockable lock off facility.

3000 ACCESSORIES

3011 TRACK LIGHTING:
Where indicated provide track for fixing fittings in accordance with BS EN 60570.

3021 INTEGRAL PHOTO-CELLS:
Incorporate integral photo-cell on luminaire where indicated, or provide photo cell control as indicated.

3031 AIR HANDLING LUMINAIRES:
Provide assembly of luminaire and exhaust air device or luminaire and supply air device to meet design requirements for illumination and air flow. Ensure assembly can be integrated into a false ceiling, flush mounted as indicated on the drawings
Fixing-Ensure the fixing is capable of carrying the weight of the whole assembly.
Provide air-flow/noise performance data and air flow / light output characteristics.

4000 WORKMANSHIP

4011 ORIENTATION:

Install luminaires in accordance with the drawings, and in horizontal plane unless otherwise indicated. Orientation of lamps to be consistent throughout installation.

4021 CLEANLINESS:
Ensure luminaires are clean and grease free on handover.
Use gloves to prevent contamination of optical components as recommended by the manufacturer.

4031 INSTALLATION OF RECESSED FITTINGS:
Install luminaires flush with finished ceiling level.
Install ground recessed luminaires taking into account the guidance given in Table A.1 of BS EN 60598-2-13.

4040 INSTALLATION OF SEMI-RECESSED FITTINGS:
Install luminaires as manufacturer's detail.

4050 INSTALLATION OF WALL MOUNTED FITTINGS:
Install luminaires at height indicated.

4061 MATERIAL OF SUPPORTING SURFACE:
Ensure classification of luminaires is appropriate. Do not mount luminaires on or adjacent to readily flammable surfaces.

4070 INSTALLATION IN POTENTIALLY EXPLOSIVE ATMOSPHERES:
Comply with BS EN 60079.

4080 LUMINAIRES IN AREAS WITH INFRA-RED CONTROL SYSTEM:
Install luminaires in areas with infra-red control systems or data bearers so as to cause minimum disturbance to the infra-red transmission system in accordance with BS 7693.

4101 INSTALLATION OF EXTRA LOW VOLTAGE TUNGSTEN HALOGEN LAMPS:
Use same wattage lamp on luminaires fed from common transformer. Supply each luminaire on common transformer by separate cable of same cross-sectional area and length.

4110 SUPPORT
Ensure support is adequate for weight of luminaires.
Provide the following minimum number of supports for each luminaire longer than 600mm.

Luminaire Width mm	Minimum number of supports
Up to and including 300	2
Over 300	4

4120 SUPPORT FROM CONDUIT:
Where luminaire is supported from conduit provide a conduit box forming an integral part of conduit system at each point of suspension. Ensure suspensions are vertical.
Where conduit enters luminaire use back-nuts and washers to secure luminaire body to conduit support. Provide tube with corrosion resistance equal to conduit system.
Do not support luminaires directly from conduit boxes made from non-metal or heat sensitive materials, where the temperature of the material may exceed 60°C or the mass suspended exceeds 3kg.

4130 SUPPORT FROM TRUNKING:
Where luminaire is supported from trunking use proprietary clamps or brackets appropriate to the luminaire and trunking.
Do not support luminaires directly from trunking made from non-metal or heat sensitive materials, where the temperature of the material may exceed 60oC or the mass suspended exceeds 3kg.

4141 SUPPORT BY DIRECT FIXING:
Refer to fixing methods as manufacturer's recommendations.

4151 SUPPORT IN SUSPENDED CEILING:
Support luminaires directly from building fabric and independent of ceiling unless otherwise indicated.

4160 SUSPENSION:
Suspend luminaires at height indicated. Ensure suspensions hang vertically unless otherwise indicated.

4170 SUSPENSION BY ROD:
Use washers, nut and lock-nut at top and bottom of rod. Paint cut ends with calcium plumbate primer or zinc rich paint.

4180 SUSPENSION BY CHAIN:
Use hook cover for suspension from circular conduit box. For connection to luminaires use luminaire manufacturer's own chain hook, but if not available use hook with standard screw threaded body to be secured to luminaire body with nuts and washers. Where indicated use captive hooks.

4190 SUSPENSION BY FLEXIBLE CORD:
Suspend cord from ceiling rose.

4200 SUSPENSION BY BALL AND SOCKET:
Install cable through ball and socket connected to conduit box.

4205 WIRE ROPE SUSPENSION SYSTEM:
Only use where specified within the Scope of Works or Schedules.
Proprietary Wire Rope Suspensions Systems which comply with BS EN 12385-1, BS EN 13411-3, BS EN 13411-4, and BSRIA COP 22/2002. Wire Rope Suspensions to be suitable for the safe working load and comprise Stainless Steel grade 316 wire rope, Stainless steel grade 302 Spring fasters with fixings by loops, stud (permanently fixed to wire rope length) or toggle as appropriate. The installation shall comply with BSRIA COP 22/2002

4211 COLUMNS AND BOLLARDS
Location-Confirm location before excavation.
Bases- Install bases or supervise work by others.
Mounting-Mount column or bollard on base as recommended by manufacturer.
Ensure columns and bollards are vertical.
Earthing-Install circuit protective conductor to connect luminaire to earthing terminal in service compartment; size circuit protective conductor same as live conductors. Bond accessible metal parts of column or bollard to earthing terminal.

4220 CONNECTIONS TO LUMINAIRES
Cable Protection -Use appropriate size of grommet where cables enter through hole in luminaire body.
Earthing-Ensure that the earthing terminal of luminaire is connected to the conduit protective conductor of the supply circuit.
Loose Wiring-Clip or tie back with suitable proprietary devices loose wiring within luminaire, at 300mm intervals.

4231 CONNECTIONS TO LUMINAIRES - DIRECT TO CONDUIT:
Terminate circuit wiring in luminaire terminal block using loop-in system taking all conductors through same cable entry of luminaire , unless stated otherwise in work section V21.

4241 CONNECTIONS TO LUMINAIRES - DIRECT TO TRUNKING:
For lighting trunking terminate wiring in luminaire terminal block using loop-in system taking all conductors through the same cable entry of luminaire, unless stated otherwise in work section V21.

4250 CONNECTIONS TO LUMINAIRES - SUSPENDED FROM TRUNKING:
Where luminaires are suspended from trunking, secure plug and socket type ceiling rose to BS 546, adjacent to, or on side of, trunking. Terminate circuit wiring at socket. Take flexible cord from plug of ceiling rose to supply terminals of luminaire.

4261 CONNECTIONS TO LUMINAIRES - RECESSED FITTINGS:

Where luminaires are recessed in a suspended ceiling, terminate circuit wiring at plug and socket type ceiling rose to BS 546, located not more than 500mm from the access through the ceiling. Use flexible cord from plug of ceiling rose to supply terminals of luminaire.

4270 CONNECTIONS TO LUMINAIRES - CONDUIT SUSPENSION:
Terminate circuit wiring in terminal block within supporting conduit box. Use flexible cable from terminal block to luminaire, installed within tube.

4280 CONNECTIONS TO LUMINAIRES - ROD OR CHAIN SUSPENSION:
Terminate circuit wiring in terminal block within supporting conduit box. Use flexible cord from terminal block to luminaire and clip cable to one of the rods or chains, do not weave cable through links of the chain.

4290 CONNECTIONS TO LUMINAIRES - MICS CABLE:
Fix cable gland to luminaire and continue conductors to supply terminals of luminaire.

4301 LIGHTING SWITCHES ON DIFFERENT PHASES:
When lighting switches on different phases are in a common box, use phase barriers in accordance with BS 7671. Provide warning label.

10000 NES Y73 TEXT Dec 19 and V41 June 17

1000 GENERAL
Install all switches, controls, outlets and meters in accordance with BS 8300 Parts 1 and 2 and legislation appropriate to the building location.

1010 APPLICATION:
Supply fixed electrical wiring accessories for use with fixed and portable peripheral equipment using either power or signalling cables.

1020 SAMPLES:

Where indicated submit samples of proposed materials and equipment for approval before work is started. Label each sample with name, catalogue number and services in connection with item.

1021 ACCESSORIES SUPPLIER:

Unless otherwise indicated source all accessories from the same manufacturer.

2000 PRODUCTS/MATERIALS

2011 ACCESSORIES - COMMON REQUIREMENTS

Provide accessories as detailed in the Work Sections / schedules and shown on drawings.
General requirements for electrical accessories to BS 5733.
Boxes and enclosures for electrical accessories to BS EN 60670 series.
Area of installation – as detailed in particular specification.
Enclosure box to BS 4662 for recessed (flush) mounting, with performance and safety standards in accordance with BS EN 60670-1.
Enclosure box to BS 5733 for surface mounting
Unless scheduled otherwise, degree of protection to BSEN 60529

IP30 Interior
IP54 Exterior

Hazardous area classification to BS EN 60079-14 as scheduled.
Enclosure degree of mechanical protection IK code to BS EN 62262 as scheduled.
Switches for Home and Building Electronic Systems (HBES) to comply with BS EN 50428 or BS EN 60669-2-5.
Coverplates to be overlapping unless otherwise specified
Enclosure material and finish to match conduit system. Enclosures to be recessed unless otherwise specified.

2021 INTERIOR LIGHTING SWITCHES:

Standard
BS EN 60669-1
Enclosure box to BS 4662, BS 5733 or BS EN 60670-1 as appropriate
Switchtype

Switches shall incorporate rocker bars unless otherwise specified. For emergency lighting a secret key switch shall be used with rocker bars as other switches in that area. If dimmers and/or press switches are shown on drawings then they shall be of the same rocker bar pattern as the switches in that area.

Rating of all the switches to be 15A. Mounting to be on an adjustable steel grid. All switches shall have a snap action microgap mechanism. Pole configurations as indicated on the drawings.
Electronic control switches e.g. dimmer switches and time switches are to comply with relevant part of BS 60669,
Ancillaries

Earthing terminal integral within switch box.
Blank inserts in all spare ways.
Neon's, shrouds, red rocker bars and operating keys as specified.

2022 PULL CORD SWITCHES

Standard
BS EN 60669-1 and BS EN 61058-2-1.
Rating of all the switches to be 16A for lighting circuits and 40-45A for showers, fans etc as specified. Mounting shall be surface. All switches shall have a snap action microgap mechanism. Pole configurations for 40-45A switches shall be DP and for 16A as specified (ie 1 way, 2 way, SP or DP).
Ancillaries

Earthing terminal integral within switch box.
Neon indicator lamp.
Integral patress for surface mounting.

2031 EXTERIOR LIGHTING SWITCHES:

Standard

BS EN 60669-1.
Enclosure box to BS 4662, BS 5733 or BS EN 60670-1 as appropriate.

Switch type shall be either rocker bar with sealed-in plastic membrane or rotary disc or lever operating through sealing gland. Rating of all switches shall be 15A. Action shall be two position, unless otherwise stated. Enclosure pattern shall be weatherproof and shall be surface, unless otherwise stated. Enclosure material shall be galvanized cast iron or impact resistant moulded plastic.
Ancillaries
Earthing terminal integral within switch box.
For neon etc shall be as indicated on the drawings.

2041 TIME SWITCHES:
Wire timer and switch circuits to separate terminals. Information regarding control and additional specification for time switches used for lighting is in work section V21, for all other uses see work section V20.
Standard BS EN 60730-2-7.
Time switch type shall be quartz stabilized motor with 30 hour spring reserve or quartz stabilized solid state with a minimum of 50 hour nickel cadmium battery backup unless otherwise specified.
Enclosure shall be dustproof sheet steel or impact resistant moulded plastic with viewing panel and arranged for conduit entry, unless otherwise indicated.

2051 LUMINAIRE CONNECTORS:
Rating shall be 5A.
Connector type
Load carrying captive cord grip type plug/socket and clip-on cover to BS 5733, BS 546 or BS 5733 Load Supporting BS 7001 (3 or 4 pin as appropriate).
Load carrying capacity to match connected luminaire.
Cover plate finish white moulded plastic.

2071 ISOLATING SWITCHES:
Provide isolating switches for fixed appliances, with utilization category and making capacity as indicated.
Standard - BS EN 60669-1
Enclosure box to BS 4662, BS 5733 or BS EN 60670-1 as appropriate.

Standard – BS EN 60947-3
Enclosure box - BS 4662, BS 5733 or BS EN 60670-1, BS EN 60947-3.
Isolation during repair and maintenance - BS EN 62626-1
Standards - BS EN 60669-1 and BS EN 60669-2 or relevant parts of BS EN 61058 or BS EN 60947-1 / BS EN 60947-3 and BS EN ISO 62626-1 to suit the application.
Mounting to be on an adjustable steel grid. Engrave front plate to indicate equipment served. Switch type toggle.
Ancillaries
Earthing terminal integral within switch box.
Neon indicator with red lens.
Cord outlet with cord grip.

2081 FUSED CONNECTION UNITS SWITCHED AND UNSWITCHED:
Standard - BS 1363-4.
Enclosure box to BS 4662, BS 5733 or BS EN 60670-1 as appropriate.
Engrave front plate to indicate equipment served.
Pole configuration to be DP switched or unswitched as shown on the drawings.
Ancillaries
Fuses to BS 1362 sized as indicated.
Cord outlet and cord grip, where scheduled.
Neon indicator where scheduled.

2091 SOCKET-OUTLETS:
Standards
13A socket-outlet to BS 1363-2 (2016 or later)
13 A plug tops to BS 1363-1.
Enclosure box to 4662, BS 5733 or BS EN 60670-1 as appropriate.
Home and Building Electronic systems to BS EN 60669-2-5.

Where RCD is incorporated the RCD to be in accordance with BS 7288.
Gangs - 2.

Socket outlets shall be single or twin and DP switched or unswitched as shown on drawings. The rating shall be 13A. Provide separate earth terminals for termination of cpc's suitable for high protective conductor currents, where scheduled or where circuits are identified.
Ancillaries
Plug tops, provide for 25% of outlets.
Where protected outlets specified extend outlets to have either a spring flap covering whole of outlet, or screw type weathering cap and chain.
Neon indicator where specified.

2091F SOCKET-OUTLETS - DOUBLE WITH INTEGRAL USB CHARGING, SWITCHED:
Standard
Socket-outlet to BS 1363-2 (2016 or later).
Enclosure box to BS 4662, BS 5733 or BS EN 60670-1 as appropriate.
HBES systems to BS EN 50428 or BS EN 60669-2-5.
USB charging in accordance with BS EN 62680-1-1
Switching - Switched.
Rating - 13 A.
Ancillaries - two USB charging socket-outlets
Gangs - 2.

2091H SOCKET-OUTLETS - INDUSTRIAL, UNSWITCHED:
Standard
Socket-outlet to BS EN 60309-2.
Enclosure box to BS 5733 or BS EN 60670-1 as appropriate
Voltage, poles, interlocking and BS EN 60529 ingress protection rating
Ensure socket-outlets have an ingress protection rating not less than IP44.
Ensure socket-outlets for use outdoors or in areas with sprays, water jets or excessive splashing have an ingress protection rating of not less than IP66

2091I SOCKET-OUTLETS - INDUSTRIAL, SWITCHED:
Standard
Socket-outlet to BS EN 60309-2, switched socket-outlet assembly BS EN 60309-4.
Enclosure box to BS EN 60309-4, BS 5733 or BS EN 60670-1 as appropriate.
Isolation provided for use during repair and maintenance in accordance with BS EN 62626-1
Voltage, poles and BS EN 60529 ingress protection rating
Ensure socket-outlets have an ingress protection rating not less than IP44.
Ensure socket-outlets for use outdoors or in areas with sprays, water jets or excessive splashing have an ingress protection rating of not less than IP66
Ancillaries and interlocking - as scheduled.

2095 DUAL USB CHARGING OUTLETS:
Standard
Electrical safety to BS EN 62368-1 or BS EN 60950-1.
Enclosure box to BS 4662, BS 5733 or BS EN 60670-1 as appropriate.
HBES systems to BS EN 50428 or BS EN 60669-2-5.
USB battery charging in accordance with BS EN 62680-1-1
Supply voltage: AC 230 V 50 Hz.
USB charging socket-outlets
Quantity - 2.
Output voltage and current to BS EN 62680-1
Ensure that the BS EN 60664-1 installation overvoltage category is suitable for the intended installation conditions at the point of connection to the fixed installation in accordance with BS 7671 (IET Wiring Regulations).

2101 COOKER CONTROL UNIT:
Standard - BS 4177. Enclosure box to BS 4662, BS 5733 or BS EN 60670-1 as appropriate.

With integral 13 A switched socket-outlet and pilot light.
Pole configuration to be DP switched. The rating shall be 45A.

2111 CORD OUTLETS:

Standard - BS 5733 and BS EN 61058-2-1.
Engrave front plate to indicate equipment served. Rating shall be 20A for all outlets except cooker and for cooker outlets 45A. Pole configuration to be DP & E.
Ancillaries
Cord grid. Cord Set to BS EN 60799.
Terminal block sized for cables.
For cooker 2x10mm^2, for all others 2x2.5mm^2

2121 CABLE AND APPLIANCE COUPLERS:

Standards
Industrial couplers, BS EN 60309-1, BS EN 60309-2.
Appliance couplers for household and similar general purposes BS EN 60320-2-2.
Material polycarbonate male and female type connectors.
Colour
25V, Violet.
50V, White.
110 - 130V, Yellow.
220 - 240V, Blue.
380 - 415V, Red.
500 - 750V, Black.
Degree of protection to BS EN 60529
Internal- IP 44.
External - IP 67
Ancillaries as indicated on drawings. RCD's in accordance with BS 7288.

2125 REMOTE CONTROL STATIONS

Standard - BS EN 60947-5-1
Actuator colours and marking to BS EN 60073.
Ensure rated thermal current, rated operational current and utilisation category of contacts are compatible with control circuit characteristics and circuit protection device.
Provide local isolation of equipment for safe maintenance, where necessary, to:
Relevant parts of BS EN 60947, BS EN 62626-1 as appropriate.

2131 TELEPHONE AND DATA OUTLET SOCKETS:

Standard - For jack socket to BS 6312-2.1 and BS 6312-2.2 or RJ 45,LJU.
Size shall be standard unless otherwise indicated. Circuit configurations as indicated on drawings. Connections shall be insulation displacement type unless otherwise indicated.
Enclosure box to BS 4662.

2151 D TYPE MULTIPIN CONNECTORS:

Circuit configurations as indicated on drawings. Connections shall be solder terminals. Size and circuit configuration (single or twin) shall be as indicated on drawings.

2161 BNC SOCKETS:

Circuit configurations as indicated on drawings. Connections shall be crimp terminals. The impedance of the outlet shall be 75 ohm. The mounting shall be insulated unless otherwise indicated. Connections shall be insulation displacement type unless otherwise indicated.
Ancillaries shall be dust caps for sockets unless otherwise indicated.

2171 AERIAL SOCKETS:

Standards BS EN 50083 and BS EN 60728-11
Circuit configurations (single or twin UHF, VHF, TV, FM or DAB or satellite Intermediate frequency as indicated on drawings. Connections shall be insulation displacement type unless otherwise indicated
Ancillaries safety isolation to CAI recommendations for communal aerial systems.

2181 LOW VOLTAGE ISOLATING TRANSFORMER UNITS:

Standards

BS EN IEC 61558-1 for general safety requirements for transformers
BS EN 61558-2-4 for isolating transformers
BS EN 61558-2-6 for safety isolating transformers
BS EN 61558-2-15 (in medical locations).

The configuration shall be single phase, double wound. Rating - Input 230V/ Output power 1500VA, unless otherwise indicated on the drawings.

Type	Output Voltage	Description
V1	110V	For power tools in plantrooms with plug and socket to BS EN 60309-1
V2	24V	For portable lights in plantrooms
V3	110/24V dual	For power tools and portable lights in plantrooms

Ancillaries – Unless scheduled otherwise

Plug and socket for 110V, Plug and socket for 25V, DP switch primary supply, Centre tapped secondaries, secondary side fusing.

2191 SHAVER POINTS:

Provide shaver points, internally switched by plug insertion.

Standard – BS EN 61558-2-5.

Enclosure box to BS 4662, BS 5733 or BS EN 60670-1 as appropriate.

Components - Double wound single phase transformer 230/230V and 110V, with internal overload protection.

Outlet compatibility for:

UK shaver plugs to BS 4573
2-pin Europlug to BS EN 50075
US 2-pin plug to NEMA 1-15

2201 INDICATOR LAMPS:

Standard BS EN 62094-1.

Lamp – LED unless detailed otherwise in the scope of works or schedules.

Coding principles for indicators (lens colour) to BS EN 60073.

Lens retaining rings - Moulded plastic unless detailed otherwise elsewhere.

3000 WORKMANSHIP

3010 EARTHING:

Ensure metal framework of equipment is bonded to main earth point. Ensure that cable CPC's are connected to earth bar.

Provide earth CPC between earth lug on metal box and accessory casing except where accessory is encased in plastic.

3020 PROTECTION:

Ensure there is no physical or electrical damage to accessories when they are removed from their packaging and during installation.

Provide masking covers for surface mounted accessories to protect surface from paint.

Where accessories are flush mounted install front plate after painting is finished.

3030 FIXING:

Align accessories horizontally and vertically, as indicated. Where accessories are grouped, mount horizontally in line and parallel to each other and equidistant.

Fix cover plates to boxes with brass fixing screws.

3041 MEASURING MOUNTING HEIGHTS:

Take measurement for position of electrical accessories to the centre line of equipment from either finished floor or worktop. Where specified height coincides with top of tiling, leave a clear gap of 50mm above tiling.

3051 STANDARD WALL-MOUNTED ACCESSORIES MOUNTING HEIGHTS:

Mounting heights shall be in accordance with Schedule Y74sch2, unless indicated otherwise.

For locations not listed provide common mounting heights for accessories of a similar type and function, considering the function of the accessory, its use in the workplace, facility or infrastructure, and any risks to health, safety and welfare.

Ensure mounting heights for sockets and accessories comply with the following standards as relevant to the use of the building:

Approved Document M Volume 1
Approved Document M Volume 2
BS 8300 Parts 1 and 2
IET Guidance Note 1: Selection and Erection

10000 NES Y74 TEXT Dec 19

1010 INSPECTION AND TEST PROCEDURE:

Comply with:

BS 7671 (IET Wiring Regulations) for requirements for initial and/or periodic verification of low voltage electrical installations in general.

Relevant parts of BS EN 61557 and IET Guidance Note 3: Inspection and Testing for methods and measuring equipment, monitoring and methods.

BS EN 60079-17 for appropriate safety precautions when undertaking inspection and testing in potentially explosive atmospheres.

Adopt progressive testing where necessary.

1020 SUPPLY CHARACTERISTICS:

Obtain information called for in BS 7671 about supply characteristics from Supplier, other than where to be measured as part of testing procedure.

1030 DESIGN INFORMATION:
Obtain all design assumptions, calculations and any other information to enable compliance with BS 7671 to be verified.

2010 INCORPORATED EQUIPMENT CHARACTERISTICS:
Obtain and use information from manufacturers of equipment provided.
Use information provided, for equipment supplied by others and incorporated into installation.

2021 PROSPECTIVE FAULT CURRENT:
Determine values of prospective fault current (I_{pf}) by measurement, unless other means are indicated as described in Appendix 14 of BS 7671. Determine I_{pf} at all necessary points within installation to confirm correct equipment selections.
Where necessary obtain from supply undertaker values of I_{pf} at the origin of the installation. Adjust subsequent measured values of I_{pf} accordingly. Where alternative supply arrangements are available select the arrangement giving rise to the highest I_{pf} value.

2030 INITIAL VERIFICATION:
Carry out detailed inspection to verify the requirements of BS 7671 Section 643 in the order given in Section 643.

2041 TEST EQUIPMENT AND CONSUMABLES:
Provide test equipment and consumables in accordance with relevant standards and manufacturers' instructions to complete tests satisfactorily, and to retest any failed installations following corrective measures.
Standards
Test equipment and accessories to relevant parts of BS EN 61557, relevant parts of BS EN 61010, and Health and Safety Executive Guidance Note GS38 Electrical test equipment for use of low voltage electrical systems.
Test equipment quality assurance requirements to BS EN ISO 10012.

2051 TESTING
Carry out in the same order as published the tests required by BS 7671 Section 643.

2061 CONTINUITY OF PROTECTIVE CONDUCTORS:
Confirm continuity. Use AC or DC source

2071 PROTECTION BY AUTOMATIC DISCONNECTION OF SUPPLY:
Using a test current of at between 20 A and 25 A, measure and record external earth fault loop impedance Z_e.

If alternative supply arrangements are available, determine the lowest and highest values of Z_e.
Verify the highest value of earth fault loop impedance Z_{db} for each distribution board.
If alternative supply arrangements are available, verify the earth fault loop impedance Z_{db} for each distribution board when using the supply arrangement with the highest impedance.
Measure the highest value of earth fault loop impedance Z_s for each circuit, and verify that each circuit meets the requirements of Chapter 41 of BS 7671, including the effectiveness of any supplementary protective equipotential bonding where necessary.
If alternative supply arrangements are available, verify each circuit's earth fault loop impedance Z_s when using supply arrangement with highest impedance.

Where residual current devices are used for automatic disconnection of supply, verify their operation using test equipment meeting BS EN 61557-6, taking into account the operating characteristic of the device in accordance with Table 3A in Appendix 3 to BS 7671.
For IT systems, verify compliance with Regulation 411.6 of BS 7671 using methods identified in Regulation 643.7.1 c).

2080 SETTINGS AND ADJUSTMENTS:

Confirm characteristics and settings of protective devices are within maximum and minimum specified tripping times.
Check correct operation of devices.
Confirm interlocks and sequences operate safely and as indicated.

2091 STANDBY GENERATORS:

Perform works tests on standby generators and provide test certificates.
Comply with BS 5000-3 and BS 5000-11 or BS EN 60034-3 as appropriate.
Carry out load test where specified within Work Sections.
Allow for attendance by the Engineer to witness works tests.
Carry out special tests where indicated in the Works Sections.

2101 HV AND LV SWITCHGEAR:

Perform works tests on HV and LV switchgear in accordance with BS EN 62271-200 and relevant parts of BS EN 61439 as appropriate, and provide test certificates.
Allow for attendance by the Engineer to witness works tests.
Carry out special tests where indicated in the Work Sections.

2111 HV POWER TRANSFORMERS:

Perform works tests on HV power transformers in accordance with BS EN 60076-3, BS EN 60076-4 and BS EN 60076-5 and provide test certificates.
Allow for attendance by the Engineer to witness works tests.
Carry out special tests where indicated in the Works Sections

2121 SPECIALIST INSTALLATIONS:

Carry out site testing and inspection and provide test certificates for specialist installations in accordance with:-

fire detection and alarm systems – relevant parts of BS 5839.
evacuation alert systems – BS 8629
lightning protection - BS EN 62305
fire protection for electronic equipment installations - BS 6266.
fire extinguishing installations and equipment on premises – relevant parts of BS 5306.
emergency lighting installations and equipment on premises - BS 5266-1, BS EN 50171, BS EN 50172 and BS EN 13032-1 as appropriate.

Fire Alarm, Voice Alarm and Evacuation Alert System Installations:

The voice alarm system shall be tested in accordance with BS 5839-8. In particular the following shall be performed;

- All communications and speaker circuit wiring shall be tested for insulation resistance, continuity, presence of earth loops and polarity prior to commencing commissioning.
- Load on each output circuit (subsequent to completion of audibility measurements and final setting of loud speaker tapings).

The Fire Alarm Trade Contractor shall carry out audibility measurements in all areas of the building to ensure that minimum audibility levels have been achieved in accordance with BS 5839 for fire alarm installations and BS EN 50849 and BS 5839- 8 for Voice Alarm Installations.

The Evacuation Alert System Trade Contractor shall carry out audibility measurements in all flats to ensure that the minimum audibility levels have been achieved in accordance with BS 8629 Clause 10.2.

Audibility measurements shall be performed once areas are complete (including all finishes and furnishings where provided within the Contract) and plant operational under normal conditions. The Fire Alarm Trade Contractor shall allow to adjust loudspeaker tap settings to achieve a sound level within the ‘preferred’ range. Following adjustments to loudspeaker tapings, audibility measurements shall be repeated.

Results of final audibility measurements and 'as-installed' loudspeaker tap settings shall be recorded on Record Drawings.

For Voice Alarm Systems, subjective assessment of intelligibility may be acceptable during commissioning and for system demonstration prior to acceptance, if this is the preferred method of the Building Control / Fire Officer. In the event of a dispute, measurements shall be taken in accordance with BS EN 60268-16, any costs associated with these measurements shall be borne by the Electrical Trade Contractor.

Standby power supplies shall be subjected to a discharge test to demonstrate that they have sufficient capacity to maintain power to the system in its quiescent and alarm states, for the rated durations. Dummy loads shall be added to the system to simulate loads allowed for future capacity.

For radio liked systems, the following records relating to the radio data should be recorded where applicable:

1) the system coding (i.e. system address) which should, where possible, be unique to avoid the

possibility of interference;

2) the system's channel/frequency; and

3) details of the signal levels received at, or from, each evacuation alert device, including signal levels relating to all the radio devices and the background noise level, and confirmation that these signal levels are in compliance with the manufacturer's recommendations.

2131 CALIBRATION:

Provide current certificates of calibration for all instruments used during test procedures. Record particular instrument identity on record sheets.
Ensure that the method of calibration meets the quality assurance requirements of BS EN ISO 10012 and that all reference sources are traceable to United Kingdom Accreditation Services (UKAS) accredited standards.

2141 CERTIFICATION AND REPORTING:

Complete and hand over to the Client a Completion or Periodic Inspection Certificate to BS 7671 Section 644 and Appendix 6 or New Installation or Additions or Alterations to an Existing Installation as appropriate.
Append any risk assessments and other documentation required by BS 7671 to the certification.
Append inspection and test results to the certificates.

2151 INSTALLATION CERTIFICATES:

Provide installation certificates for electrical installations in accordance with BS 7671 (IET Regulations) Section 644 and Appendix 6.
Certificates shall be accompanied by a complete schedule of test result:
Record details of departures from BS 7671 (IET Wiring Regulations) on certificate.
Where appropriate provide copies of calculations justifying departure from BS 7671 (IET Wiring Regulations) and attach to certificates.
Append any risk assessments and other documentation required by BS 7671 to the certification.
Append inspection and test results to the certificates.

2161 RECORDS:

Record all results and instrument readings on approved Record Sheets and hand over to the client two copies for each inspection and test, as soon as possible after such inspection and test.
Append results of testing to BS 7671 (IET Wiring Regulations) to the certification provided in accordance with Section 644.

3000 WORKMANSHIP

3011 EXTRANEOUS-CONDUCTIVE PARTS AND PROTECTIVE BONDING:

Test for protection against direct and indirect contact in accordance with BS 7671 (IET Wiring Regulations) dependant on the method of protection.

Verify that all extraneous-conductive-parts of the installation are adequately connected to the main earth terminal in accordance with BS 7671 (IET Wiring Regulations).
Verify that all extraneous-conductive-parts of a location are effectively connected by protective bonding. Unless protection against electric shock requires a lower value, verify that the impedance of main protective bonding does not exceed 0.1Ω
Where additional protection is provided by supplementary protective bonding, verify that the resistance is sufficiently low to provide the required additional protection requirements of Chapter 41 of BS 7671, between simultaneously-accessible extraneous-conductive-parts and/or exposed-conductive-parts.
Confirm the classification of conductive parts which are not verified as either exposed-conductive-parts or extraneous-conductive-parts of the location, as defined in BS 7671 (IET Wiring Regulations). Demonstrate that their impedance to the earthing terminal of the location is sufficiently high, in accordance with Section 13.5 of IET Guidance Note 5: Protection Against Electrical Shock, using appropriate values of human body resistance R_b and maximum current through the human body I_b for the installation conditions and external influence

3020 PHASE SEQUENCE:
Check and confirm correct polarity of all conductors in all circuits.

3031 HIGH VOLTAGE TESTS:
Carry out high voltage tests as indicated:
Comply with relevant parts of BS 923, BS EN 61180, BS EN 60060 and BS EN 61180 as appropriate.

3041 CABLES:
Test continuity and insulation of all cables and carry out HV tests on HV cables prior to handover.
Test continuity and insulation of buried cables immediately after back-filling.

3051 CONDUIT, TRUNKING AND DUCTING:
Test and confirm electrical continuity of metal containment systems before installing cables.

10000 NES TEXT Y81 Dec 18

2000 PRODUCTS/MATERIALS

2011 LABELS AND NOTICES:
Apply identification labels and notices in accordance with BS 7671 (IET Wiring Regulations), Section 514 to all electrical cables plant and equipment including components of mechanical systems. Fit labels and notices as shown on drawings or specified in the Work Sections.
BS 7671 Labels and Notices
Identification of protective devices.
Diagrams, charts or tables to comply with Clause 514.9, 560.7.9, 560.7.10 and 560.7.11 and as indicated.

Warning notices, voltages in excess of 230 volts to earth.
Isolation notices
Periodic inspection and test notices.
Residual current device quarterly notices.
Earth electrode safety electrical connection label.
Bonding conductor connector point to extraneous conductive parts label.
Earth free local equipotential bonding areas warning notice.
Electrical separation areas warning notice.
Outdoor equipment socket outlet notice.
Circuits with high protective conductor current (Regulation 543.7.1.205).
Wiring complying with previous versions of Section 514 (Regulation 514-14-1)
Operating instructions to comply with clause 560.7.12.
Warning notice, non-standard wiring colours.
Warning notices, alternative sources of supply

2021 MATERIALS:

Use materials for labels and notices with a predicted life equal to or greater than the design life of the electrical cables, plant, equipment or installation to which it refers.
Ensure durability of identification is to BS ISO 17398.
External- Engraved thermosetting plastic laminate.

Internal - Engraved thermosetting plastic laminate.

Labels shall be coloured in accordance with The Health and Safety (Safety Signs and Signals) Regulations 1996, and associated HSE guidance L64 generally as follows:

Application	**Background Colour**	**Colour of Lettering / Symbols**
Prohibition, danger alarm notices	RED	WHITE
Warning notices	YELLOW AMBER	BLACK
Identification or descriptive notices	WHITE	BLACK
Mandatory notices	BLUE	WHITE
Emergency escape / First Aid notices	GREEN	WHITE

2031 FIXING:

Fix labels and notices using materials compatible with label or notice and surface to which it is fixed using fixing screwed into tapped hole. Use adhesives only with written consent from the Engineer.

2041 ARRANGEMENT:

Obtain approval prior to manufacture, with regard to style, colour, lettering, size and position of all labels and notices. Provide sample showing style, colour, lettering and size, for approval.

2051 LETTERING AND SIZE OF LABELS AND NOTICES:

Ensure that all lettering and symbols comply with the requirements laid out in BS 7671 (IET Wiring Regulations), Section 514 and BS ISO 3864-1 for height of lettering where not otherwise indicated. Ensure labels and notices of adequate size for the lettering required, and allow a minimum margin around all lettering of one line space vertically and two letter spacing horizontally.

Font - Helvetica Medium unless otherwise indicated.

2060 CONDUCTOR ARRANGEMENT:

Arrange circuit polarity so that phases read in phase rotation order followed by the neutral, if any, from top to bottom in horizontal conductor layouts and left to right in vertical conductor layouts. Ensure flat horizontal arrays have leading phase to the left and neutral to the right from left to right when viewed from supply point. Arrange phase or live pole of two wire apparatus at top or left hand and neutral and earth both at bottom or right hand side. In all cases, ensure conductor arrangements defined are when viewed from front face of all equipment and terminating facilities. Apply identification markers in accordance with BS 7671 (IET Wiring Regulations), section 514 to all conductor termination points.

2070 SAFETY SIGNS:

Label all electrical plant and equipment in accordance with relevant parts of BS ISO 3864 and provide safety signs complying with BS EN ISO 7010. Provide sign W012 where voltages above ELV exist.
Label all electrical plant and equipment with the labels specified in the appropriate British Standards for that plant or equipment.
Identify each substation and main switchroom
For any fire extinguishing system provide signs in accordance with BS EN ISO 7010
Give details of,

- Name of the Substation or switchroom.
- The presence of High and Low Voltages.
- Administrative instructions for access.
- Location and method of contacting controlling authority.
- Actions to be taken in an emergency.

Position safety signs in accordance with BS 5499-10.

2080 PLANT AND EQUIPMENT LABELS:
Fit labels on all items of plant, equipment, switches, etc., include the following information:-

- service controlled.
- circuit reference.
- voltage, type of supply and phase etc.
- circuit protection type and rating.

2085 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:
Graphical symbols for use on equipment to be created and applied in accordance with BS EN 80416-1, BS EN 80416-2, BS EN 80416-3.

2090 MAINTENANCE NOTICES:
Fix notices giving warning of, and instructions on, any special maintenance procedures to plant and equipment.

2091 MOULDED CASE CIRCUIT-BREAKER - WARNING LABEL
Where moulded case circuit breakers are used in the construction of a switchboard or panel board the contractor shall provide a warning notice in minimum print. size of 5mm letters fixed in a prominent position clearly visible from the operating side of the switchboard or panel board to warn of possible danger as follows:-

WARNING LABEL
ALL MOULDED CASE CIRCUIT- BREAKERS WHICH TRIP FOR ANY REASON DURING OPERATIONAL USE MUST BE VISUALLY INSPECTED FOR ANY FORM OF DAMAGE PRIOR TO ANY ATTEMPT BEING MADE TO RESET THE DEVICE TO SERVICE CONDITION.

Reference to manufacturers recommendations and instructions for use and operation of MCCB devices must be identified in all operations and maintenance documentation.

2092 SUPPLIES TO FIRE FIGHTING AND LIFE SAFETY SYSTEMS
Every switched disconnector and protective device that can isolate the supply to fire fighting or life safety system plant, equipment or controls shall be labelled (using white characters on a red background) as follows:

Device	Label Text (XXX = system refer below)
Protective device that only serves fire fighting or life safety plant or controls, but incorporates no switch.	"XXX"
Protective device or switched disconnector that only serves fire fighting or life safety plant or controls.	"XXX : DO NOT SWITCH OFF"

Additionally the following labels shall be provided depending on whether the device(s) is supplied from the live or dead side on the main isolating device:

Supply Arrangement	Label Text (XXX = system refer below)

Device supplied from the dead side of the main isolating device.	"WARNING: THIS SUPPLY REMAINS LIVE WHEN THE MAIN SWITCH IS TURNED OFF"
Main isolating device – Devices served from the live side	"WARNING: THE XXX SUPPLY(IES) REMAIN(S) LIVE WHEN THIS SWITCH IS TURNED OFF"
Main isolating device – Devices served from the dead side	"WARNING: THIS SWITCH ALSO CONTROLS THE SUPPLY(IES) TO THE XXX CIRCUIT(S)"

System	Label Text Replacing XXX
Generally or a combination of the below sytems	"FIRE FIGHTING / LIFT SAFETY SYSTEMS"
Emergency voice communication system (EVC)	"EMERGENCY VOICE COMMUNICATION SYSTEM"
Evacuation alert system	"EVACUATION ALERT SYSTEM"
Fire alarms or Fire and Voice Alarms	"FIRE ALARM SYSTEM"
Voice alarms	"VOICE ALARM SYSTEM"

2100 COLOUR CORRECTED LIGHT FITTINGS:

Fix a warning or identification disc to light fittings containing colour corrected fluorescent tubes or other colour corrected light sources to ensure that maintenance staff install the correct lamps.

2101 ELV LIGHTING TRACKS

Where ELV lighting tracks are intended to serve extra-low voltage luminaires without integral transformers a warning label shall be affixed either to the track or adjacent to the track. The label shall be engraved; 'WARNING: Transformer fed track. No more than n x 50 watt 12 volt fittings (or equivalent) to be connected to this track'. Where 'n' is the maximum quantity appropriate to the transformer rating.

2110 MOTORS AND STARTERS LABELS:

Fit identification labels to all motors, starters and starter panels. Ensure positive identification of respective motors and starters. Provide motors with non-corrodible labels attached adjacent to each bearing giving details of the lubricant to be used. Mark direction of normal rotation on motor casing. Provide labels to identify motor equipment fitted with surge suppressors and thermistors stating that insulation test voltages must not be applied to thermistors and thermistor control units. Ensure labelling is compatible with schematic and wiring diagrams, and complies with BS EN 60034-8. Labels fitted at manufacturers Works or, if indicated otherwise, labels fitted at site.

2121 ENGRAVED ACCESSORY PLATES:

Engrave switchplates, spur units, pushes and special plates for bedhead units, call systems, fire alarms, etc. as indicated. Use 6mm high letters with engraving coloured red, except where otherwise indicated.

2131 SWITCHGEAR:

Fit labels on switchgear as required by BS 7671 and relevant parts of BS EN 61439 to indicate duty of unit, its voltage, phase and current rating, protective device rating size of conductor involved, and all other necessary details. Use an agreed serial coding system, provide at the switch a key to the coding system, as required.

Any identification of a switchboard busbar or conductor shall comply with the requirements of BS 7671 Table 51, so far as these are applicable.

2141 DISTRIBUTION BOARDS:

On each distribution board identify every outgoing way with a renewable circuit chart in a transparent plastic envelope permanently fitted inside distribution board cover. Clearly indicate in typed script, circuit identification number, cable size, fuse or circuit breaker rating and a description of item and area supplied by circuit.

Where final circuits are intended to serve circuits with high protective circuit currents, provide labels in accordance with BS 7671, Regulation 543.7.1.5.

Where alterations or additions are made to an installation that includes conductors identified using colours complying with versions of BS 7671 prior to Amendment No2:2004, a warning notice complying with

Regulation 514.14.1 shall be affixed to each switchboard or distribution board which serves circuits wired using both the current and previous versions of BS 7671.

2161 SPECIAL PURPOSE EARTHING:

Fit labels to special purpose earthing conductors and connection points, describing their purposes and any instructions necessary for their operation and maintenance.

Earthing and bonding networks for buildings with telecommunications, information technology and control system installations in accordance with BS EN 50310 and BS 7671.

Telecommunications functional earths as BS 6701.

2171 INDICATOR LAMPS AND PUSH BUTTONS FOR POWER SYSTEMS:

Use indicator lamp and push button colours in accordance with BS EN 60073.

Indicator lamp	Red	-	danger or alarm.
	Yellow	-	caution.
	Green	-	safety.

Where not defined submit details of proposed colours for other lamps.

Push buttons	Red	-	emergency action.
	Red	-	stop or off.
	Yellow	-	intervention.
	Green	-	start or on.

Where not defined submit details of proposed colours for other lamps.

2180A CONDUIT AND TRUNKING COLOUR CODING:

In areas of mechanical plant or voids accommodating mechanical services, or where otherwise indicated, identify electrical conduits and ducts in accordance with BS 1710. Apply colour orange to BS 4800 by painting on service as a band over 150mm or applying an adhesive tape type wrap around services over a length of 150mm.

Place identification colours at bulkheads, wall penetrations and any other place where identification is necessary.

Provide colour coding where specified in Work Sections for special applications

2191 CABLE IDENTIFICATION:

Provide all cables, other than final sub-circuit wiring enclosed in conduits or trunking, with labels fixed at each end of cable, either side of wall and floor penetrations, at approximately 12m intervals on route or at convenient inspection points by means of non-releasable plastic straps unless otherwise stated.

Ensure labels show the following information:-

Reference number of cable.

Size and number of conductors.

2192 SCHEMATIC DIAGRAMS:

Provide a purpose made schematic diagram permanently fixed showing the connections of the equipment and plant.

Locations	-	At main switchgear, (fixed to structure).
Materials	-	Printed paper, transparent cover and framing, or printed paper, encapsulated.

2201 TERMINAL MARKING AND CONDUCTOR IDENTIFICATION:

Provide for switchgear and control gear elements whose terminals are marked in accordance with BS 5472 (EN 50005) and BS 6272 (EN 50042). Use a unique reference to identify each element in the switchgear or control gear. Mark on or adjacent to each element its reference. Identify each terminal for connection to external wiring or cabling using a reference system complying with BS EN 60445 based on the element reference and the appropriate element terminal reference and BS 7671, where applicable.

On terminals use lettered or numbered ferrules or sleeves to BS 3858 to mark each auxiliary conductor or control cable core with the identity of the terminal to which it is connected and the reference of plant or equipment to which it is connected and the identity of the terminal at the remote end. Ensure that main circuit conductors are identified in accordance with BS 7671 (IET Wiring Regulations) Section 514. Ensure that all identification of terminals and conductors is recorded and included on record drawings and in operation and maintenance documentation.

At each interface between conductors identified using colours or markings complying with versions of BS 7671 prior to Amendment No2:2004, identification ferrules shall be fitted to the existing conductors marked in accordance with BS 7671 Appendix 7 Table 7A or Table 7E, as appropriate.

2211 UNDERGROUND CABLE IDENTIFICATION:

Identify external underground cable routes by means of approved concrete markers along their length at distances not exceeding 35m and where a change of direction occurs on such routes. Provide cables markers with a brass plate or impress concrete to clearly indicate the reference number of the cable and operating voltage of cable.

Provide key to any reference system used at switchgear.
Mark direct buried cables with plastic tape yellow printed black as detailed below:-.

WIDTH	up to 600mm	600-1000mm	1000-1400mm	1400-1800mm
DEPTH up to 500mm	1 tape at 200mm below ground level in the centre of the trench	2 tapes at 200mm below ground level horizontally spaced 400mm apart	3 tapes at 200mm below ground level each tape horizontally spaced 400mm apart	4 tapes at 200mm below ground level each tape horizontally spaced 400mm apart
DEPTH 500-800mm	1 tape at 200mm and 1 tape at 500mm below ground level in the centre of the trench	2 tapes at 200mm and 2 tapes at 500mm below ground level each tape on each level horizontally spaced 400mm apart	3 tapes at 200mm and 3 tapes at 500mm below ground level each tape on each level horizontally spaced 400mm apart	4 tapes at 200mm and 4 tapes at 500mm below ground level each tape on each level horizontally spaced 400mm apart

2221 CABLE CONDUCTOR COLOUR CODING:

Identify cable conductors in accordance with BS 7671 (IET Wiring Regulations) Regulation 514 and Appendix 7, note that a lighting sub-circuit switch wire is a phase conductor in a single phase circuit.
In alterations or additions to existing installations identify conductors and terminals as BS 7671 Appendix 7.
All single phase final sub-circuit phase wiring carried out-using single core cables shall be coloured brown. Where multi-core cables are used for switch wires, blue, black or grey conductors shall be coded Brown at terminations.

2231 CABLE JOINTING AND TERMINATION:

Connect all cables in the installation so that the correct sequence of phase rotation is maintained throughout. Where straight through joints are approved joint high voltage conductors as they lie, ensuring their complete length is phased out on completion. Ensure connections at terminations of HV cables are made in the correct phase rotation and ensure cable conductor termination marking if any, complies with this phase sequence. Where straight through joints are approved on low voltage cables, whether power cables, control or auxiliary cables, joint conductors strictly in accordance with their colour or numeric coding. Where such joints are approved on mineral insulated or other non-coded conducted cables, identify each core at the joint and make the joint core to core.

2241 CABLE SHEATH IDENTIFICATION - INTERNAL:

Use the following coloured cables sheaths and cable codes for various services as follows:

Service	Sheath Colour	Cable Code
Fire alarm / Evacuation Alert Systems	Red	FA
Clock circuits	Brown	CL
Telecommunications	Grey	T
Data	As system suppliers requirements or as indicated	D
Control	Black	C
Radio frequency	Black	RF
Low voltage	Black	LV
Low voltage mineral insulated	Orange, unless otherwise indicated on the drawings	
Low voltage essential circuits	Blue	
Extra low voltage control	Brown	ELV

High voltage	Red	HV

2251 CABLE SHEATH IDENTIFICATION - EXTERNAL:

Identify cable sheaths for various services in accordance with NJU Guidelines on the Positioning and Colour Coding of Utilities' Apparatus, as follows,

HV	-	Red.
LV	-	Black.
Telecommunications and data	-	Grey.

2261 ADDITIONAL SAFETY SIGNS:

Comply with BS ISO 3864-1 for design principles for safety signs and safety markings.

Application

For main switch and electrical plant room access doors - BS EN ISO 7010 - P011 & P004 with supplementary sign "Authorised persons only".

For use with permit to work systems - BS EN ISO 7010 - P031. Printed on rigid plastic, with hanging loop, with supplementary wording "Do not operate. Work in progress".

For use at each emergency stop - BS EN ISO 7010 with supplementary sign "Emergency stop push-button".

10000 NES Y82 TEXT May19

1010 PREPARATION:

Mark-out, set out and firmly fix all equipment, components and necessary brackets and supports.

1020 MANUFACTURER'S DRAWINGS:

Use manufacturer's drawings and templates for purposes of marking and setting out.

1030 FIXINGS:

Ensure structure and fixings are suitable for items to be fixed.

1040 LOADING DETAILS:

Provide loading details for all fixing types.

1050 BUILDING-IN BY OTHERS:
Provide all necessary assistance to enable any item of building-in type to be built in by others.

1060 SIZE OF FIXING:
Use largest size of bolt, screw or other fixing permitted by diameter of hole in item to be fixed.

1070 GREASING OF FIXINGS:
Ensure all bolts, screws or other fixings used are greased or lubricated in accordance with manufacturer's instructions.

2000 PRODUCTS/MATERIALS

2010 STANDARDS:
Ensure that fixings such as expanding anchors are tested for tensile loading and where appropriate resistance to loading in shear.

2020 PLUGS:
Use plugs of suitable size and length for fixings. Use plastic, fibrous or soft metal non-deteriorating plugs to suit application. Do not use wood plugs.

Ensure that when screw is in place, threaded length is in plug. Ensure plugs used for screw fixing are set-in to correct depth prior to final tightening.

2030 SCREWS:
Generally use sheradized steel wood screws for fixing to concrete, brickwork or blockwork.
In damp or exposed situations use greased brass wood screws.

2040 CAST-IN FIXINGS:
Where cast-in fixings are permitted, mark out and set fixings in accordance with manufacturer's instructions.

2050 SHOT FIRED FIXINGS:
Obtain approval prior to using shot fired type fixings.

2060 SELF ADHESIVE FIXINGS:
Obtain approval prior to using self-adhesive type fixings.

2070 PROPRIETARY CHANNEL INSERTS:
Provide proprietary channel inserts for casting in where indicated.

2081 NON-PENETRATIVE SUPPORT SYSTEMS FOR ROOF MOUNTED EQUIPMENT:
Obtain approval prior to using non-penetrative support systems for roof mounted equipment.
Ensure that the roof build-up is suitable for non-penetrative supports.
Install in accordance with the manufacturer’s recommendations.

3000 WORKMANSHIP

3010 DRILLING:
Drill holes squarely. Use drills of requisite size and depth, and appropriate to fabric. Do not flame-cut holes in metal work.

3020 PROPRIETARY FIXINGS:
Comply with manufacturer's instructions for all fixings.

3031 FIXING TO REINFORCED CONCRETE:
Take precautions to avoid fixing through reinforcement. Unless otherwise indicated do not fix to the bottom, or within 100mm of the bottom, on the sides of concrete beams.

3040 FIXING TO BRICKWORK:
Do not fix to unsound material or mortar between brickwork courses.

3050 FIXING TO TIMBER RAILS:
Fix equipment, brackets and supports by drilling hole through timber rail and fixing with bolt, back plate, washer and loose nut.

3061 FIXING TO HOLLOW STUD/TILE/BLOCK WALLS:
Fix equipment, brackets and supports where there is access at rear of wall, by drilling hole through wall and fixing with bolt, back-plate, washer and loose nut.
Fix equipment, brackets and supports where there is no access at rear of wall, drill hole and use, screw anchor type fixing, or gravity type toggle fixing or spring type toggle fixing.

3071 FIXING TO CONCRETE, BRICKWORK OR BLOCKWORK
Fix equipment, brackets and supports using wood screws in plugs or drill holes and fix using steel bolts of grouted bolt type or expanding bolt type fixing, as required.

3081 FIXING TO METALWORK:
Fix equipment, brackets and supports by drilling holes and fixing using either self-tapping screws or gravity type toggle fixing or spring type toggle fixing or set screws or bolts complete with washers, shakeproof washers and loose nuts as recommended by the manufacturer

3091 FIXING TO STRUCTURAL STEELWORK AND CONCRETE STRUCTURES:
Provide manufacturer's information on recommended fixing. Obtain approval for any fixing to structure steel work and concrete structures.
Generally use proprietary fixings to structural steelwork and concrete structures.
Obtain approval to cut holes in structural steelwork or concrete structures or weld to structural steelwork.

3101 NON-PENETRATIVE SUPPORT SYSTEM FOR ROOF MOUNTED EQUIPMENT / SERVICES
Where detailed in the scope of works or on the drawings or offered as an alternative to traditional mounting methods, a proprietary system shall be provided. Systems to comprise a free standing, galvanized steel frame, assembly and support bases to spread the load.
Support frames must not penetrate the roof waterproofing membrane or insulation, but shall facilitate easy access to the roof waterproofing for the purpose of future repair and renewal by others.
The system manufacturer shall submit loading calculations for approval by the structural engineer based on the limiting UDL deck loading, maximum point loads and maximum base pressures.
Ensure that future roof maintenance access to roof finish is provided under each support system

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1010 GENERAL REQUIREMENTS:
Where particular methods of finish and painting are not specified, ensure following requirements are met.
Protect all metal work, plant, equipment, pipelines and fittings, ductlines, ancillaries, brackets and supports against corrosion and oxidization.
Provide ferrous metals, machined or otherwise with protective coatings at manufacturer's works.
Ensure all items requiring on-site decorative finishes are provided primed to suit base material and required finish.

1020 DAMAGED FINISHES:
Following delivery to site, storage on site and installation make good any damage to finishes, by cleaning, degreasing and re-furbishing.

2000 PRODUCTS/MATERIALS

2011 PAINT MATERIALS:

Use the following materials as appropriate:

PAINT / COATING	MATERIAL
Solvent borne priming paint to BS 7956	Bare woodwork
Red Oxide priming paint	Bare iron & steelwork
Zinc Chromate priming paint	Bare ferrous & non-ferrous metals
Calcium Plumbate priming paint to BS 3698	Galvanised steel or composite wood/metal components
Undercoating paints / Gloss finishing paint to BS 7664	For previously primed or painted surfaces before application of finishing coats Previously primed or painted/ undercoated surfaces
Epoxy resin paint	Specialist coatings calling for resistance to acids, alkalis, oils, solvents, abrasion, or high humidity, unless otherwise indicated
BS 4842, BS 6496	Paints for aluminium alloys
Powder coating to BS EN 13438	Previously galvanized or sherardised steel products, for architectural (internal and external application), fencing and construction purposes.
Aluminium paint to BS 388	Structural steelwork, storage vessels, heated metallic surfaces and similar applications calling for moisture and heat resistant properties, unless otherwise indicated
Cold galvanizing paint	Making good damage to previously galvanised surfaces and protection to galvanised materials modified during the installation process, unless otherwise indicated
Zinc-rich metallic to BS 4652	Bare iron and steelwork where electrical conductivity has to be ensured
Black tar-based paint to BS 1070	Moisture resistant protection to metal surfaces where decorating appearance is not important
Bitumen based coatings for cold application to BS 3416	Protection of iron and steel, typically steel pipelines and fittings for use in contact with potable water
Bitumen based coating for cold application to BS 6949	Not to be used in contact with potable water

2020 PAINT QUALITY:

Ensure paints used are of quality and type to suit application and that:-

primers have good adhesion, covering power, rust-inhibiting and grain filling properties.

gloss finishing paints are of machine finish grade having high adhesion and high resistance to solvents, mineral oils, cutting oils, detergents, chipping and impact damage.

2030 HEAT RESISTANT PAINT:

Use heat resistant paints for applications to surfaces over 80°C.

3000 WORKMANSHIP

3010 GENERAL:

Ensure paints are applied in accordance with manufacturer's instructions and to BS 6150 as appropriate.

3020 WEATHER AND OTHER CONDITIONS:

Do not apply paints where weather, temperature, humidity or other conditions may have a damaging effect upon finish or paint.

3030 CLEANING:

Ensure metal surfaces are thoroughly cleaned, all mill and weld scale removed and finally degreased.
Clean steel surfaces to relevant parts of BS EN ISO 8503.
Prepare surfaces for painting in accordance with BS EN ISO 4618.

3040 APPLICATION OFF-SITE:
Wherever possible ensure paint finishes applied by component manufacturers are spray applied.

3050 APPLICATION:
Apply paint evenly and ensure finish shows no excessive brush marks, grinning, runs, sagging, ropiness or other application defects.

3060 COLD GALVANIZING:
Repair damage to galvanized components due to installation process, i.e. following cutting, drilling or welding, by applying 2 no. substantial coats of cold galvanizing paint.

3070 PROTECTION OF BRIGHT MACHINE PARTS:
Apply a protective coating to all bright machined parts before despatch from works.
Do not remove protective coatings unless required for installation, testing or commissioning purposes and in such cases reinstate upon completion.
Repair any damaged protective coating or bright machined part, or where necessary replace damaged component.
Use and apply metal coatings as required and in accordance with manufacturer's instructions.
Complete where possible all welding, drilling, bending and other work before metal coating.

3081 DRAINAGE PIPEWORK WHERE VISIBLE EXTERNALLY
Where rainwater or drainage pipework is visible externally or is in a quasi-external location such as car park areas paint the system with 2 coats of black bitumen paint.

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1010 STANDARDS:
Supply and install motors in accordance with BS EN 50347, for dimensional requirements of general purpose 3-phase induction motors, relevant parts of BS EN 60034, BS EN 62262 and BS 4999 as appropriate; and local supply authority regulations.
Electrical equipment intended for use in potentially hazardous areas / explosive atmospheres to comply with relevant parts of BS EN IEC 60079/BS EN 60079 and be tested, certified and marked that the equipment is fit for its intended purpose and that adequate information is supplied with it to ensure that it can be used safely.

1020 ELECTRICAL SUPPLY:
Ensure all electrical equipment supplied and installed is suitable for power supply indicated.

1030 PERFORMANCE CHARACTERISTIC DETAILS:
Provide details of electrical input, starting and performance characteristics of all motors above 750W to an agreed format.

1040 MANUFACTURER FITTED SURGE SUPPRESSORS:
Supply built-in surge suppressors to star connected motors and to all motors subject to star-delta starting to limit peak voltage to 1200 volts. Fitted by manufacturer.

1060 MOUNTING:
When duplicate motors are required for automatic changeover, mount separately, ensure each is complete with drive and guard and make due allowance for power loss of idling motor.

1070 KEYS:
Ensure motors and drives are supplied complete with keys and keyways.

2000 PRODUCTS/MATERIALS

2011 OPERATING CONDITIONS:
Ensure motors, starters and ancillary equipment are suitable for operation at full capacity at heights above sea level not exceeding 1000m, with air cooling at an average temperature over 24 hours not exceeding 35^0C dry bulb with maximum conditions of 40^0C dry bulb and 50 per cent RH; above 1000m, with conditions exceeding 40^0C dry bulb and 50 per cent RH; or as defined in the "A" series Work Sections, whichever is the most onerous.

2021 MOTORS - GENERAL:
Standard
Use motors which conform to relevant parts of BS EN 60034, as applicable, which operate at lowest possible speed, compatible with performance requirements.

Terminal markings and direction of rotation to be in accordance with BS EN 60034-8
Provide isolation during repair and maintenance work in accordance with BS EN 62626-1
Comply with EC Regulation 640/2009 and amendment EU Regulation 4/2014 with regard to ecodesign requirements for electric motors.
Ratings
Select maximum continuous rating (MCR) such that:-
driven machine operates at correct speed or speeds at design duty.
when running continuously at design rated duty, the temperature of the motor parts is within limits defined in BS EN 60034-1.

When provided with excess motor current (over-load) protection of thermal over current release type, ensure operation is within tolerances of tripping as defined in BS EN 60947-4-1
Insulation
Use motors with Class 130 or 155 insulation, with temperature rise all as defined in BS EN 60085
Conduit entry
Fit motor bodies with conduit entry terminal box or cable gland as required, and to suit type and size of cable being terminated.
Enclosures
Provide protected enclosures as indicated.
Comply with BS EN 60034-5 and BS EN 62262 to achieve the specified degrees of protection classification provided by the integral design.

2026 MOTOR EFFICIENCY:
Unless specified otherwise in the particular specification or schedules all single speed three phase cage induction motors from 0.75kW to 375kW shall be IE3 or IE2 with a variable speed drive in accordance with BS EN 60034-30-1.
Nominal efficiency limits for IE3 and IE2 are given in the tables below / overleaf.

IE3 Motor Efficiency Limits (%) for 50 Hz: figures taken from

BS EN 60034-30-1 Table 7				
Rated Power (kW)	No. of Poles/Synchronous Speed (RPM)			
	2/3000	4/1500	6/1000	8/750
0.12	60.8	64.8	57.7	50.7
0.18	65.9	69.9	63.9	58.7
0.20	67.2	71.1	65.4	60.6
0.25	69.7	73.5	68.6	64.1
0.37	73.8	77.3	73.5	69.3
0.40	74.6	78.0	74.4	70.1
0.55	77.8	80.8	77.2	73.0
0.75	80.7	82.5	78.9	75.0
1.1	82.7	84.1	81.0	77.7
1.5	84.2	85.3	82.5	79.7
2.2	85.9	86.7	84.3	81.9
3	87.1	87.7	85.6	83.5
4	88.1	88.6	86.8	84.8
5.5	89.2	89.6	88.0	86.2
7.5	90.1	90.4	89.1	87.3
11	91.2	91.4	90.3	88.6
15	91.9	92.1	91.2	89.6
18.5	92.4	92.6	91.7	90.1
22	92.7	93.0	92.2	90.6
30	93.3	93.6	92.9	91.3
37	93.7	93.9	93.3	91.8
45	94.0	94.2	93.7	92.2
55	94.3	94.6	94.1	92.5
75	94.7	95.0	94.6	93.1
90	95.0	95.2	94.9	93.4
110	95.2	95.4	95.1	93.7
132	95.4	95.6	95.4	94.0
160	95.6	95.8	95.6	94.3
200 and above	95.8	96.0	95.8	94.6

IE2 Motor Efficiency Limits (%) for 50 Hz: figures taken from BS EN 60034-30-1 Table 5				
Rated Power (kW)	No. of Poles/Synchronous Speed (RPM)			
	2/3000	4/1500	6/1000	8/750
0.12	53.6	59.1	50.6	39.8
0.18	60.4	64.7	56.6	45.9
0.20	61.9	65.9	58.2	47.4
0.25	64.8	68.5	61.6	50.6
0.37	69.5	72.7	67.6	56.1
0.40	70.4	73.5	68.8	57.2
0.55	74.1	77.1	73.1	61.7
0.75	77.4	79.6	75.9	66.2
1.1	79.6	81.4	78.1	70.8
1.5	81.3	82.8	79.8	74.1
2.2	83.2	84.3	81.8	77.6
3	84.6	85.5	83.3	80.0
4	85.8	86.6	84.6	81.9
5.5	87.0	87.7	86.0	83.8

7.5	88.1	88.7	87.2	85.3
11	89.4	89.8	88.7	86.9
15	90.3	90.6	89.7	88.0
18.5	90.9	91.2	90.4	88.6
22	91.3	91.6	90.9	89.1
30	92.0	92.3	91.7	89.8
37	92.5	92.7	92.2	90.3
45	92.9	93.1	92.7	90.7
55	93.2	93.5	93.1	91.0
75	93.8	94.0	93.7	91.6
90	94.1	94.2	94.0	91.9
110	94.3	94.5	94.3	92.3
132	94.6	94.7	94.6	92.6
160	94.8	94.9	94.8	93.0
200 and above	95.0	95.1	95.0	93.5

2026C IE4 MOTORS:

Where an IE4 motor is specified in the schedules or scope of works / particular specification, the minimum efficiency shall be compliant with BS EN 60034-30-1 as shown in the table below:

IE4 Motor Efficiency Limits (%) for 50 Hz: figures taken from BS EN 60034-30-1 Table 9				
Rated Power (kW)	No. of Poles/Synchronous Speed (RPM)			
	2/3000	4/1500	6/1000	8/750
0.12	66.5	69.8	64.9	62.3
0.18	70.8	74.7	70.1	67.2
0.20	71.9	75.8	71.4	68.4
0.25	74.3	77.9	74.1	70.8
0.37	78.1	81.1	78.0	74.3
0.40	78.9	81.7	78.7	74.9
0.55	81.5	83.9	80.9	77.0
0.75	83.5	85.7	82.7	78.4
1.1	85.2	87.2	84.5	80.8
1.5	86.5	88.2	85.9	82.6
2.2	88.0	89.5	87.4	84.5
3	89.1	90.4	88.6	85.9
4	90.0	91.1	89.5	87.1
5.5	90.9	91.9	90.5	88.3
7.5	91.7	92.6	91.3	89.3
11	92.6	93.3	92.3	90.4
15	93.3	93.9	92.9	91.2
18.5	93.7	94.2	93.4	91.7
22	94.0	94.5	93.7	92.1
30	94.5	94.9	94.2	92.7
37	94.8	95.2	94.5	93.1
45	95.0	95.4	94.8	93.4
55	95.3	95.7	95.1	93.7
75	95.6	96.0	95.4	94.2
90	95.8	96.1	95.6	94.4
110	96.0	96.3	95.8	94.7
132	96.2	96.4	96.0	94.9
160	96.3	96.6	96.2	95.1
200 and above	96.5	96.7	96.3	95.4

2030 SLIDERAILS

Fit motors on slide rails or other suitable means of adjustment to facilitate correct alignment and belt tension.

2040 PLINTHS

Where plinths are built in by others, provide all necessary assistance and information.

2061 MOTORS - OVER TEMPERATURE PROTECTION THERMISTORS:

Fit positive temperature coefficient thermistors to BS EN 60043-11. Provide a minimum of 3 PTC thermistors in each motor with 2 ends terminated in motor terminal box clearly and permanently marked.

For motor ratings between 30kW & 75kW provide a single thermistor in each phase.

For motor ratings 75kW and above provide two thermistors in each phase.

Provide control unit to BS EN 60034 to motors fitted with thermistors. Interconnect control unit with thermistors and starter to trip starter when one or all of thermistors detect overheating.

2062 MOTORS BELOW 0.37 kW:

Provide fuses or circuit breakers for motors below 0.37 kW.

2071 INDIRECT DRIVES:

Belt drives - standard – BS 3790

Use endless standard 'V' or where required use toothed belts both in accordance with BS 3790. Provide at least two matched belts for any drive, of anti- static type and rated to transmit full machine power with one belt removed.

Pulleys

Construct pulleys from approved materials and statically balance. Lock close limit bores by keys fitting into machinery shaft keyway.

Pulley Adjustment

Adjust pulley to give alignment and correct belt tension.

2081 DIRECT COUPLED DRIVES:

Use an extended motor shaft coupled to machine, or a flexible coupling connecting driving and driven shafts, incorporate suitable arrangements for aligning the two shafts.

Mount motors on a substantial mild steel bed plate fixed to machine casing separately supported or supported entirely from the machine casing.

2085 VARIABLE SPEED DRIVE:

Also refer to clause Y72.2191 and plant schedules.

Use variable speed drive to match design and installed flow volume. Ensure the drive meets the safety requirements of BS EN 61800-5-1. Select drives to meet design duty at 45Hz unless specified otherwise in work section W60

Load characteristic - variable torque for fans and pumps; constant torque for positive displacement equipment such as positive displacement pumps and air compressors.

Electrical and control characteristics - CE marked and conforming to EMC and the Machinery Directives. The drives should be equipped with overcurrent and fault protection means; clearly indicate the range of operational supply and control voltages (AC/DC / no. of wires), with communication and BMS capabilities e.g. MODBUS; and be configurable using bluetooth and/or ethernet and/or BACnet protocols.

2091 GUARDS:

Totally protect drives and couplings. Fit purpose made guards around all exposed or otherwise accessible drive shafts, pulleys, 'V' belts or couplings.

Ensure guards comply with National or Local Safety Codes, Acts and Bye-Laws and incorporate following features:-

Construction to BS EN ISO 12100 and generally of galvanized steel wire mesh.

Stiffening within the guards to ensure rigidity and freedom from vibration.

Allowance for prime mover adjustment during belt tensioning procedures.

Temporary access to all shafts for use of Tachometer.

Any special features as indicated.

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A11sch1 – Schedule of Drawings

Drawing No	Description	Drawing type	Scale
60663039-ACM-ZZ-ZZ-DR-BS-042002	Typical Utility Cupboard Detail, Sheet 1 of 4	Details	
60663039-ACM-ZZ-ZZ-DR-BS-042003	Typical Utility Cupboard Detail, Sheet 2 of 4	Details	
60663039-ACM-ZZ-ZZ-DR-BS-042006	Typical Utility Cupboard Detail, Sheet 3 of 4	Details	
60663039-ACM-ZZ-ZZ-DR-BS-042007	Typical Utility Cupboard Detail, Sheet 4 of 4	Details	
60663039-ACM-ZZ-ZZ-DR-BS-042004	Typical Corridor and Riser Detail Layout, Sheet 1 of 2	Layout	
60663039-ACM-ZZ-ZZ-DR-BS-042005	Typical Corridor and Riser Detail Layout, Sheet 2 of 2	Layout	
60663039-ACM-ZZ-RF-DR-BS-020001	Typical Block Roof Level Combined Services Layout	Layout	
60663039-ACM-ZZ-GF-DR-BS-060001	Typical Block Ground Floor BWIC Layout	Layout	
60663039-ACM-ZZ-ZZ-DR-BS-060001	Typical Block Typical Floor BWIC Layout	Layout	
60663039-ACM-ZZ-RF-DR-BS-060001	Typical Block Roof Level BWIC Layout	Layout	
60663039-ACM-A3-GF-DR-BS-300001	Block A3 Water Services & UPS Plantroom – Mechanical & Electrical Services Layout	Layout	
60663039-ACM-00-ZZ-DR-ME-301100	House A1(P) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301101	House A1(P) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301102	House A1(A) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301103	House A1(A) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301104	House A2(P) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301105	House A2(P) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301106	House A2(A) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301107	House A2(A) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301108	House D1(A) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301109	House D1(A) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301110	House D1(P) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301111	House D1(P) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301112	House B2(P) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301113	House B2(P) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301114	House B2(A) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301115	House B2(A) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301116	House B3(P) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301117	House B3(P) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301118	House C1(P) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301119	House C1(P) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301120	House C1(A) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301121	House C1(A) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301122	House C3(P) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301123	House C3(P) Mechanical Services Layout, Sheet 2 of 2	Layout	

60663039-ACM-00-ZZ-DR-ME-301124	HouseH1(P) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301125	HouseH1(P) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301126	House F1(P) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301127	House F1(P) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301128	House F1(A) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301129	House F1(A) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301130	House J1(P) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301131	House J1(P) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301132	House K1(P) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301133	House K1(P) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301134	House K1(A) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301135	House K1(A) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301136	House H2(P) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301137	House H2(P) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301138	House J1(A) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301139	House J1(A) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301140	House K1(P) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301141	House K1(P) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301142	House K2(P) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301143	House K2(P) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301144	House B3(A) Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-ME-301145	House B3(A) Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-A1-ZZ-DR-ME-300001	Apartment Type 1 - Block A1, 2 Bed 4 Person, Private Unit, Mechanical Services Layout	Layout	
60663039-ACM-A1-ZZ-DR-ME-300002	Apartment Type 2 - Block A1, 1 Bed 2 Person, Private Unit, Mechanical Services Layout	Layout	
60663039-ACM-A1-ZZ-DR-ME-300004	Apartment Type 4A - Block A1, 2 Bed 4 Person, FOG Affordable Unit, Mechanical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-A1-ZZ-DR-ME-300005	Apartment Type 4A - Block A1, 2 Bed 4 Person, FOG Affordable Unit, Mechanical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-A4-ZZ-DR-ME-300006	Apartment Type 13 - Block A4, 1 Bed 2 Person, Affordable Unit, Mechanical Services Layout	Layout	
60663039-ACM-A4-ZZ-DR-ME-300007	Apartment Type 15 - Block A4, 1 Bed 2 Person, Wheelchair Unit, Mechanical Services Layout	Layout	
60663039-ACM-ZZ-GF-DR-ME-300001	Typical Block Ground Floor Mechanical Services Layout	Layout	
60663039-ACM-ZZ-ZZ-DR-ME-300002	Typical Block Typical Floor Mechanical Services Layout	Layout	
60663039-ACM-ZZ-ZZ-DR-ME-301001	Typical Block LTHW Services Schematic	Schematic	
60663039-ACM-ZZ-ZZ-DR-ME-301002	Typical Block Ventilation + AOV Schematic	Schematic	
60663039-ACM-ZZ-ZZ-DR-ME-301003	Typical Block Apartment Ventilation Schematic	Schematic	
60663039-ACM-ZZ-ZZ-DR-ME-301004	Typical Block Apartment LTHW Schematic	Schematic	

60663039-ACM-00-ZZ-DR-EL-401100	House A1(P) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401101	House A1(P) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401102	House A1(A) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401103	House A1(A) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401104	House A2(P) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401105	House A2(P) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401106	House A2(A) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401107	House A2(A) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401108	House D1(A) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401109	House D1(A) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401110	House D1(P) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401111	House D1(P) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401112	House B2(P) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401113	House B2(P) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401114	House B2(A) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401115	House B2(A) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401116	House B3(P) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401117	House B3(P) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401118	House C1(P) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401119	House C1(P) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401120	House C1(A) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401121	House C1(A) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401122	House C3(P) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401123	House C3(P) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401124	HouseH1(P) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401125	HouseH1(P) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401126	House F1(P) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401127	House F1(P) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401128	House F1(A) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401129	House F1(A) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401130	House J1(P) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401131	House J1(P) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401132	House K1(P) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401133	House K1(P) Electrical Services Layout, Sheet 2 of 2	Layout	

60663039-ACM-00-ZZ-DR-EL-401134	House H2(P) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401135	House H2(P) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401136	House K2(A) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401137	House K2(A) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401138	House J1(A) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401139	House J1(A) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401140	House K1(P) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401141	House K1(P) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401142	House K2(P) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401143	House K2(P) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401144	House B3(A) Electrical Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-EL-401145	House B3(A) Electrical Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-A1-ZZ-DR-EL-400001	Apartment Type 1 - Block A1, 2 Bed 4 Person, Private Unit, Electrical Services Layout	Layout	
60663039-ACM-A1-ZZ-DR-EL-400002	Apartment Type 2 - Block A1, 1 Bed 2 Person, Private Unit, Electrical Services Layout	Layout	
60663039-ACM-A1-ZZ-DR-EL-400004	Apartment Type 4A - Block A1, 2 Bed 4 Person, FOG Affordable Unit, Electrical Services Layout	Layout	
60663039-ACM-A4-ZZ-DR-EL-400005	Apartment Type 13 - Block A4, 1 Bed 2 Person, Affordable Unit, Electrical Services Layout	Layout	
60663039-ACM-A4-ZZ-DR-EL-400006	Apartment Type 15 - Block A4, 1 Bed 2 Person, Wheelchair Unit, Electrical Services Layout	Layout	
60663039-ACM-ZZ-GF-DR-EL-400001	Typical Block Ground floor, Common & Landlords Areas Containment Layout	Layout	
60663039-ACM-ZZ-ZZ-DR-EL-400002	Typical Block Typical floor, Common & Landlords Areas Containment Layout	Layout	
60663039-ACM-ZZ-GF-DR-EL-400003	Typical Block Ground floor, Common & Landlords Areas Small Power & Ancillaries Layout	Layout	
60663039-ACM-ZZ-GF-DR-EL-400004	Typical Block Ground floor, Common & Landlords Areas Lighting Layout	Layout	
60663039-ACM-ZZ-ZZ-DR-EL-400005	Typical Block Typical floor, Common & Landlords Areas Lighting, Small Power & Ancillaries Layout	Layout	
60663039-ACM-ZZ-ZZ-DR-EL-400006	Typical Block Lightning Protection Layout	Layout	
60663039-ACM-ZZ-ZZ-DR-EL-402001	Typical Electrical & Comms Riser Detail	Detail	
60663039-ACM-ZZ-ZZ-DR-EL-401001	Typical Block LV Schematic	Schematic	
60663039-ACM-ZZ-ZZ-DR-EL-401002	Typical Block Door Entry, Access Control and CCTV Schematic	Schematic	
60663039-ACM-ZZ-ZZ-DR-EL-401003	Typical BlockFire Alarm Schematic	Schematic	
60663039-ACM-ZZ-ZZ-DR-EL-401005	Typical Block IRS Schematic	Schematic	
60663039-ACM-ZZ-ZZ-DR-EL-401006	Typical Block Telecom & Data Schematic	Schematic	
60663039-ACM-ZZ-ZZ-DR-EL-401004	Typical Block Earthing Schematic	Schematic	
60663039-ACM-00-ZZ-DR-PH-501100	House A1(P) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501101	House A1(P) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501102	House A1(A) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501103	House A1(A) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501104	House A2(P) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501105	House A2(P) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501106	House A2(A) Public Health Services Layout, Sheet 1 of 2	Layout	

60663039-ACM-00-ZZ-DR-PH-501107	House A2(A) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501108	House D1(A) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501109	House D1(A) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501110	House D1(P) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501111	House D1(P) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501112	House B2(P) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501113	House B2(P) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501114	House B2(A) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501115	House B2(A) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501116	House B3(P) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501117	House B3(P) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501118	House C1(P) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501119	House C1(P) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501120	House C1(A) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501121	House C1(A) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501122	House C3(P) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501123	House C3(P) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501124	HouseH1(P) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501125	HouseH1(P) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501126	House F1(P) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501127	House F1(P) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501128	House F1(A) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501129	House F1(A) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501130	House J1(P) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501131	House J1(P) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501132	House K1(P) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501133	House K1(P) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501134	House K2(A) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501135	House K2(A) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501136	House H2(P) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501137	House H2(P) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501138	House J1(A) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501139	House J1(A) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501140	House K1(P) Public Health Services Layout, Sheet 1 of 2	Layout	

60663039-ACM-00-ZZ-DR-PH-501141	House K1(P) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501142	House K2(P) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501143	House K2(P) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501144	House B3(A) Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-00-ZZ-DR-PH-501145	House B3(A) Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-A1-ZZ-DR-PH-500001	Apartment Type 1 - Block A1, 2 Bed 4 Person, Private Unit, Public Health Services Layout	Layout	
60663039-ACM-A1-ZZ-DR-PH-500002	Apartment Type 2 - Block A1, 1 Bed 2 Person, Private Unit, Public Health Services Layout	Layout	
60663039-ACM-A1-ZZ-DR-PH-500004	Apartment Type 4A - Block A1, 2 Bed 4 Person, FOG Affordable Unit, Public Health Services Layout, Sheet 1 of 2	Layout	
60663039-ACM-A1-ZZ-DR-PH-500005	Apartment Type 4A - Block A1, 2 Bed 4 Person, FOG Affordable Unit, Public Health Services Layout, Sheet 2 of 2	Layout	
60663039-ACM-A4-ZZ-DR-PH-500006	Apartment Type 13 - Block A4, 1 Bed 2 Person, Affordable Unit, Public Health Services Layout	Layout	
60663039-ACM-A4-ZZ-DR-PH-500007	Apartment Type 15 - Block A4, 1 Bed 2 Person, Wheelchair Unit, Public Health Services Layout	Layout	
60663039-ACM-ZZ-ZZ-DR-PH-500001	Typical Block PHE Detail Layout	Layout	
60663039-ACM-ZZ-ZZ-DR-PH-500003	Typical House Detail Layout, PHE Services, Sheet 1 of 2	Layout	
60663039-ACM-ZZ-ZZ-DR-PH-500004	Typical House Detail Layout, PHE Services, Sheet 2 of 2	Layout	
60663039-ACM-ZZ-GF-DR-PH-520001	Typical Block Ground floor Drainage Layout	Layout	
60663039-ACM-ZZ-ZZ-DR-PH-520002	Typical Block Typical Floor Drainage Layout	Layout	
60663039-ACM-ZZ-03-DR-PH-520003	Typical Block Third floor Drainage Layout	Layout	
60663039-ACM-ZZ-RF-DR-PH-520004	Typical Block Roof Level Drainage Layout	Layout	
60663039-ACM-ZZ-GF-DR-PH-500001	Typical Block Ground floor Water Services Layout	Layout	
60663039-ACM-ZZ-ZZ-DR-PH-500002	Typical Block Typical floor Water Services Layout	Layout	
60663039-ACM-ZZ-ZZ-DR-PH-501001	Typical Block Water Services Schematic	Schematic	
60663039-ACM-ZZ-ZZ-DR-PH-501002	Typical Block Drainage Services Schematic	Schematic	
60663039-ACM-ZZ-ZZ-DR-PH-501003	Typical Block Rainwater Schematic	Schematic	
60663039-ACM-A3-GF-DR-PH-500001	Water Services Plantroom Layout	Layout	
60663039-ACM-A3-GF-DR-PH-053001	Water Services Plantroom Replacement Layout	Layout	

A13sch – Schedule of Common Design Criteria

EXTERNAL CONDITIONS / OUTDOOR AIR CATEGORY	
Summer design temperatures: (used for cooling load calculations)	29 °Cdb 21 °Cwb
Summer design temperatures: (to be used for heat rejection plant selection)	35 °Cdb 23 °Cwb
Winter design temperatures: (used for space heating load calculations)	-4 °Cdb / 100% RH

INTERNAL ENVIRONMENTAL DESIGN / COMFORT CONDITIONS		
Living / Dinning Room	Winter No humidity control	22 °C +/- 1 °C
Bedrooms	Winter No humidity control	20 °C +/- 1 °C
Entrance Halls / Stairs	Winter No humidity control	20 °C +/- 1 °C
Kitchens	Winter No humidity control	22 °C +/- 1 °C
Bathroom / En-Suites	Winter No humidity control	20 °C +/- 1 °C
Common Staircase	Winter No humidity control	No heating
Plantrooms	Winter No humidity control	5 °C

VENTILATION	
Kitchen	Residential extract ventilation boost rate 13 L/s
Bathroom	Residential extract ventilation boost rate 13 L/s
WC	Residential extract ventilation boost rate 8 L/s
En-suite	Residential extract ventilation boost rate 8 L/s
Utiltiy cupboard	Residential extract ventilation boost rate 8 L/s
Residential Refuse Stores	10 ach / hr
Plantrooms	2 ach / hr

Design operating conditions of mechanical distribution systems:	Ground Loop operating temperature	30 °C (flow) 25 °C (return)
	UFH operating temperature	45 °C (flow) 40 °C (return)
	ductwork system pressure	l*ow*
Piped water systems pressure ratings	DCWS – PN 10 DHWS - PN 10	

PUBLIC HEALTH	
Rainwater Disposal System	
Rainfall intensity	0.064 l/s/m^2 for a 2 minute storm in accordance with BS EN 12056-3:2000 and latest LABC guidance

A13sch – Schedule of Common Design Criteria

Foul Drainage above ground	
Design	In accordance with BS EN 12056-2:2000 System III
	Frequency factor, k
All areas	0.5 (intermittent use)
Cold Water Storage	
Apartment Blocks	3 bedroom = 100 l/bedroom/day = 300 litres/apartment
(based on 8 hours storage)	2 bedroom = 130 l/bedroom/day = 260 litres/apartment
	1 bedroom = 210 l/bedroom/day = 210 litres/apartment
House types	No water storage
Residential Sprinklers	For Block A3
Water Flow Rate	Institute of Plumbing Guide
Pressure Required at tap (minimum)	200 kPa
Hot Water Generation	
	Minimum Domestic Hot Water Generation Temperatures
Storage systems:	60°C
Instantaneous systems:	55°C
Cold Water temperature	10°C

	Dwellings Specification for Electrical Services				
		Affordable Rental (AR)	**First Home (FH)**	**Private Open Market Sale (OMS)**	**Private Rental (PRS)**
	Small Power				
4.1	Twin Sockets outlets:				
	Kitchen - 2 x twin socket + USB	✓	✓	✓	✓
	Lounge - 2 x twin socket + USB	✓	✓	✓	✓
	Bedrooms - 2 x twin socket + USB	✓	✓	✓	✓
	Home/Office				
	Lounge - 2 x twin socket	✓	✓	✓	✓
	Study - 2 x twin socket	✓	✓	✓	✓
	Bedroom - 2 x twin socket	✓	✓	✓	✓
	Mid and High Brush socket in Lounge/Dining Master bedroom Office/Study	✓	✓	✓	✓
4.7	External Socket (Houses Only)				
	Rear 1x Twin	✓	✓	✓	✓
	General Power Supply for:				
	Fridge Freezer	✓	✓	✓	✓
	Wash machine	✓	✓	✓	✓
	Dish Washer	✓	✓	✓	✓
	Hob	✓	✓	✓	✓
	Cooker Hood	✓	✓	✓	✓
	Oven	✓	✓	✓	✓
	MVHR/DHW	✓	✓	✓	✓

	Towel Rails - Ensuite Bathroom/	✗	✗	✗	✗
	TV, Phone & Data outlet				
4.2	Telephone Outlets				
	Lounge	✓	✓	✓	✓
	Kitchen/Dining	✓	✓	✓	✓
	Master bed	✓	✓	✓	✓
	Bed 1	✓	✓	✓	✓
	Office/Study	✓	✓	✓	✓
4.3	TV Outlets points:				
	Lounge	✓	✓	✓	✓
	Kitchen				
	Master Bed	✓	✓	✓	✓
	Master Bed	✓	✓	✓	✓
	Office/Study	✓	✓	✓	✓
4.5	Door Bell	✓	✓	✓	✓
4.6	Consumer Unit	✓	✓	✓	✓
	LIGHT				
4.7	External lighting (Houses Only)				
	Front	✓	✓	✓	✓
	Rear/Garage	✓	✓	✓	✓
4.8	Internal Spot / Downlight in				
	Bathroom	✓	✓	✓	✓
	Kitchen	✓	✓	✓	✓
	Hall	✓	✓	✓	✓
	Landing	✓	✓	✓	✓
	Pendants in:				
	Bedrooms	✓	✓	✓	✓
	Lounge/ Dining	✓	✓	✓	✓
4.11	Garage - Fluorescent/LED tube	✓	✓	✓	✓
	Fire Alarm				
4.9	Heat Detector - Kitchen	✓	✓	✓	✓
	Smoke Detector -				
	Hall	✓	✓	✓	✓
	Lounge	✓	✓	✓	✓
	Security Alarm				
4.10	2Bed & 3Bed - fuse spare for future			✓	✓
	2Bed & 3Bed - fuse spare for future			✓	

A13sch – Schedule of Common Design Criteria

Fire Protection Services

Residential Sprinklers	
Design	BS EN 9251:2021
Protection Category	Category 3 2.8 mm/min each sprinkler (maximum of 2No. sprinklers in operation), 30 min duration. Fed from domestic cold water system with shared stored water supply. Max 25m2 per sprinkler head. System with priority demand valve on each floor riser branch. *Principles of Sprinkler Fire Protection to be verified prior to works: Fire Strategy is under development whilst this document writing; communal areas to be confirmed as managed areas considered fire sterile by the authority having jurisdiction (otherwise increase of operational sprinkler heads is required).*
Dry Riser	
Design	BS 9990:2015
Incoming service capacity	100mm inlet valve in façade

Equipment Selections
Any component pressure drops etc. quoted in individual Work Section selection schedules are "notional" figures used for the purpose of preliminary plant and motor selections.
Where "maximum" figures are quoted these are not to be exceeded when selecting equipment.

The Engineering Services Contractor shall substitute the actual pressure drops, flow rates etc. through all components, as purchased and as the final installation configuration, and recalculate equipment duties before selecting and ordering equipment and associated prime movers.

Control Valves
Select and size Control Valves with a rangeability in excess of 40 and authority not less than the following:-

Diverting & throttling applications	- 0.5
Mixing applications	- 0.3
2 way valves	- 0.25 to match system configuration

Select and size Control Valves on the index run to have maximum pressure losses not exceeding the figures quoted in clause Y20 schedule of pumps. Select and size other control valves to provide the appropriate control across the controlled device.

Control Dampers
Use opposed blade control dampers unless otherwise indicated. Select and size control dampers to provide authority as follows:-

Opposed blade	5% (ie the pressure loss across a fully open OBD is approximately 5% of the loss in the rest of the system)
Parallel blade	20%

Fans
Quoted fan duties are based on pressure losses external to any air handling unit or distribution components and on the equipment airside pressure losses stated on the schedules.
Pressure loss allowance for air filters are to be based on the ‘dirty’ condition.
Quoted fan duties include the following commissioning allowances:-

	Low Pressure Systems	Medium & High Pressure Systems
On Flow Rates	10%	5%
On Head	20%	15%

Fans heads are based on the layout drawings and specified types of duct fittings and as appropriate system resistances stated in schedule of AHU’s Y40 or schedule of fans Y41. If changes are made to the routes by the installer, fittings other than those specified are installed or the resistances of the components selected are different from those stated, adjust fan head to compensate and advise the S.O. of the adjustment.

Pumps

Quoted pump duties include the following commissioning allowances:

Flow Rate 10%

Head 15%

Pump heads are based on the layout drawings and specified types of pipe fittings and as appropriate the system resistances stated in Y20 schedule of pumps. If changes are made to the routes by the installer, fittings other than those specified are installed or the resistances of the components selected are different from those stated, adjust pump head to compensate.

Electrical Supply

230 Voltage 3 Phase 50 Frequency

Fire Detection System Classification

Type of Protection in domestic premises (BS 5839-6) Type LD1 Apartments and LD2 for houses

Internal Noise Criteria

Bedrooms:	NR 25
Living Rooms/Lounges:	NR 25
Bathrooms:	NR 35
Kitchens, hallways, stairs within apartments:	NR 40
Commercial Areas:	NR 35
Common Areas:	NR 40
Retail:	NR 45
Car Parks:	NR 45
Plantrooms:	NR 65

External Noise Criteria

Refer to the Acoustic Consultants specification

EC Harmonisation of supply voltage

This project has been designed for a normal voltage of 400/230v +10%, -6% in accordance with The Electricity Safety, Quality and Continuity Regulations 2002.

All equipment in the installation shall also operate at 415/240v ±6% as this is the likely initial supply voltage.

Limitation of Harmonics

Equipment shall comply with the limits stated in Engineering Recommendation G 5/4-1.

For a.c motor control, d.c power supplies, variable voltage controllers, and UPS equipment provide details of harmonic distortion and confirm compliance prior to ordering.

Additional Protection

Areas / Zones where the Electrical Installation **is not** under the supervision of skilled or instructed persons (where Additional Protection shall be provided in accordance with BS 7671 – IET Wiring Regulations):

A13sch2 – Schedule of Part L BER Compliance Check Data

Description	Value used in model at design stage	As constructed / commissioned values (to be confirmed by the Contractor)
Walls and Floors Performance		
Ground Floors	0.12 $W/m^2.K$	$W/m^2.K$
Floors above unheated	0.13 $W/m^2.K$	$W/m^2.K$
External Wall - Typical	0.17 $W/m^2.K$	$W/m^2.K$
External Wall - Dwarf Wall to loft	0.11 $W/m^2.K$	$W/m^2.K$
External Wall - Dormer Cheek	0.20 $W/m^2.K$	$W/m^2.K$
Corridor/core Wall	0.25 $W/m^2.K$	$W/m^2.K$
Party walls (Dwelling to Dwelling) Based on either solid OR fully filled cavity construction	0 $W/m^2.K$	$W/m^2.K$
Flat roof (insulated at ceiling)	0.09 $W/m^2.K$	$W/m^2.K$
Terrace roof	0.11 $W/m^2.K$	$W/m^2.K$
Insulated Sloped Roof	0.11 $W/m^2.K$	$W/m^2.K$
Dormer Window Roof	0.2 $W/m^2.K$	$W/m^2.K$
Glazing Performance		
Residential Windows	1.1 $W/m^2.K$	$W/m^2.K$
Solar heat gain coefficient (g-value)	0.43	
Entrance Door	1.0 $W/m^2.K$	$W/m^2.K$
Air permeability		
Air permeability rate (design and measured)	3 $m^3/(h.m^2)$	$m^3/(h.m^2)$
lighting performance		
Lumens per circuit Watt for general lighting: Corridor	Not less than 60 Lumens /circuit-watt	Lumens /circuit-watt
Total power for general lighting	kW	kW
Details of Lighting controls (i.e. occupancy sensing, photoelectric dimming, etc)	Refer to Notes	
Lumens per circuit Watt and total wattage for display lighting	Min 75 Lumens /circuit-watt	Lumens /circuit-watt
Mechanical Ventilation		
Air flow rates – local ventilation units within the local area (eg window/wall/roof units)	Refer to equipment schedule	m^3/s
Specific fan power (SFP) – local ventilation units within the local area (Please refer to equipment schedule)	0.7 W/(litre/s)	W/(litre/s)
Air flow rates – local ventilation with units remote from the area (eg ceiling void or roof mounted units) (Please refer to equipment schedule)	Refer to equipment schedule	m^3/s
Specific fan power (SFP) – local ventilation units remote from the local area (Please refer to equipment schedule)	1.5 W/(litre/s)	W/(litre/s)
Rating weighted average Specific fan power (SFP) – fan coil units (Please refer to equipment schedule)	N/A W/(litre/s)	W/(litre/s)
Efficiency of heat recovery system	84 %	%
Recirculation rates		
Ductwork leakage pressure classification (DW 143)	In line with DW143	
Ductwork leakage (at design / as commissioned pressure)	In line with DW143	$Litres/s/m^2$
% of ductwork tested	In line with DW143	%
Heating Systems		
Seasonal efficiency of heating systems or (SCoP)	3.01	
Pump power	kW	kW
Cooling Systems		
Seasonal energy efficiency ratio (EER) for cooling systems	N/A	
Pump power	kW	kW
Domestic Hot water		

A13sch2 – Schedule of Part L BER Compliance Check Data

Description	Value used in model at design stage	As constructed / commissioned values (to be confirmed by the Contractor)
Heat Generation seasonal efficiency if different from heat generation	2.32	
Storage volume	150-200 L	L
Losses from storage	68 W/hr	kW
Power Factor Correction		
Whole Building power factor correction	0.95	
Metering and Controls		
Is automatic monitoring & targeting with alarms for out of range values included	Yes	
Low & Zero Carbon energy sources		

Notes

A13sch3 – Schedule of Builders Work

Notwithstanding the requirements elsewhere in the specification and main contract preliminaries, the extent of the builders work in connection with the engineering services shall include but not be limited to the following:

1. All plant bases / inertia block bases (concrete to the Structural Engineers specification)
2. All secondary steelwork where required for services distribution / plant supports
3. Provision and fixing of all anchor points and guides
4. Installation of all pipe, duct and cable sleeves through walls, floors etc
5. Supply of puddle flanges for installation by others
6. Fixing of sanitary fittings
7. Fixing of fire damper frames and making good around frames
8. Fixing of all grilles, diffusers, luminaires and other services terminals in suspended ceilings / bulkheads etc
9. Making good around holding down bolts
10. All fire stopping around services (including the provision of sleeves as defined in the Y clauses) Comply with clause A13 210.002 or A64 310.001
    Application - All services passing through apertures in masonry walls/concrete floors or drywall partitions/systems.
    Fire resistance - as indicated on the fire strategy drawings
11. Sealing of holes around services passing through non-fire rated walls, floors and ceilings
12. All cutting and making good of holes through non-structural walls / slabs up to xxxx mm dia. Provide details of required pre-formed holes in structural slabs and walls to the structural engineer / main contractor
13. All chasing and making good
14. Open mesh or chequer plate flooring in all risers
15. All access platforms, walkways, ladders, step-overs and handrails etc for maintenance and access
16. Provision of bund walls around all water storage tanks and around pumps where indicated on the drawings
17. All lifting beams and pulley blocks to facilitate plant removal / replacement
18. Builders work in connection with louvers where not included as part of the external cladding works.
19. Ducts for building services
    a. Details - xxxxxxxxxxxxxxx
    b. When the provision of ducts in buildings for services forms part of the scope of works, comply with BS 8313 for the design, construction and installation of ducts and installation of services in the ducts.
20. External trenches and external pipe ways and pits
21. Services penetrations through building external envelope

A30schE – Schedule of Electrical Manufacturers

Equipment/Manufacturer	**Classification**					
P30 Trenches/Pipeways/Pits for Buried Engineering Services	Cable Accss Chambers (Pre-fab)	Recess Covers	Ducts	Power In-ground units	Power Pop-up units	
Cubis-systems	✓	✓				
Emtelle			✓			
Jones of Oswertey		✓				
Gatic		✓				
Peter-savage (IDS)	✓	✓				
Polypipe			✓			
Pop up power suppliess				✓	✓	
Kent Stainess Ltd				✓		
P30 Trenches/Pipeways/Pits for Buried Engineering Services Continuned	Duct Penetration seals	Puddle Flange				
Doyma		✓				
Hauff Technik		✓				
CDS Sealing system	✓					
Filoform	✓					
V10 Electricity Generating Plant	Generator Sets - Diesel Driven	Generator Sets - Gas Turbines				
AVK | SEG (UK) Ltd	✓					
BELLS (Power solution)	✓					
Broadcrown UK Limited	✓					
CAT (Caterpiller)	UPS supplier					
Centrax Limited		✓				
Cummins Power Generation Limited	✓					
Kohler Power	✓					
F G Wilson (Engineering) Ltd	✓					
Musgrave Generators Ltd	✓					
SDMO Energy Limited	✓					
V21 General Lighting	Internal Luminaires	External Luminaires	Lamps	Lighting Control Systems	Specialist Systems	Bespoke Luminaire Design
Absolute Action					✓	
ACDC					✓	
Antares	✓	✓				
Architectural FX	✓	✓			✓	✓
Artemide	✓	✓			✓	
Aquila		✓				
Bega		✓				
BLV			✓			
Bruck	✓				✓	✓
Buschfeld	✓					
Castaldi	✓	✓				

A30schE – Schedule of Electrical Manufacturers

Equipment/Manufacturer	Classification					
Chelsom	✓	✓				✓
Cini&Nils	✓				✓	
Color Kinetics	✓	✓			✓	
Concord:marlin	✓	✓				
Cooper (Menvier)	✓	✓			✓	
Coughtrie Lighting		✓				
Crescent Lighting	✓	✓			✓	
David Turner Workshop	✓					✓
Delmatic				✓		
Dernier & Hamlyn	✓					✓
Designed Architectural Lighting(DAL)	✓					✓
DeltaLight	✓	✓				
DW Windsor		✓				✓
Dynalite				✓		
DZ-Licht		✓				
Encapsulite					✓	
Erco	✓	✓		✓		
ES-System	✓	✓				
Etap	✓				✓	✓
Fagerhult	✓	✓			✓	
Flos	✓					
Flos Architectural	✓					
Forma Lighting	✓	✓				
Fusion Lighting	✓					✓
GE Lamps			✓			
Hess		✓				
Holophane		✓				
iGuzzini	✓	✓		✓	✓	
i-LED	✓	✓			✓	
iLight				✓		
Iwasaki (Eye)			✓			
John Cullen Lighting	✓					
Kreon	✓				✓	
Leax				✓		
Light Projects	✓	✓			✓	
LTS	✓	✓				
Louis Poulsen	✓	✓				
Lucent	✓					
Lucifer Lighting Co	✓					
Lucitalia	✓					
Lutron				✓		
Luxmate				✓		
Luxonic	✓	✓		✓	✓	
Marl					✓	
Martin Architectural	✓	✓			✓	

A30schE – Schedule of Electrical Manufacturers

Equipment/Manufacturer	Classification					
Martini	✓	✓				
Megaman			✓			
Meyer		✓				
Microlights	✓					✓
Mike Stoane Lighting	✓				✓	✓
Modular Lighting Instruments	✓	✓			✓	
Molto Luce	✓					
Multiload Technology				✓	✓	
Oldham Lighting					✓	
Osram			✓	✓	✓	
Philips	✓	✓	✓		✓	✓
Precision Lighting	✓				✓	
Prisma		✓				
Prolojik				✓		
Rako				✓		
Reggiani	✓	✓				
Remote Controlled Lighting	✓				✓	
Riegens Lighting	✓	✓			✓	✓
Se'lux	✓	✓			✓	✓
Sill Lighting		✓			✓	
Simmtronic				✓		
Siteco	✓	✓				
Sylvania			✓			
Targetti	✓	✓			✓	
Thorn Lighting	✓	✓				
Traxon	✓	✓			✓	
Tridonic				✓	✓	
Trilux	✓	✓			✓	
Venture			✓			
Viabizzuno	✓	✓			✓	
We-ef		✓				
Wevre & Ducre	✓	✓			✓	
Whitecroft	✓	✓				
White Goods	✓				✓	✓
Wila Lighting	✓					
Woodhouse UK plc		✓				
Z-Line	✓					
Zumtobel	✓				✓	

A30schE – Schedule of Electrical Manufacturers

Equipment/Manufacturer	**Classification**					
V32 Uninterruptible Power Supplies	Diesel Rotary	Hybrid Rotary	Static			
ABB			✓			
AVK | SEG (UK) Ltd			✓			
Constant Power Services Ltd / Riello SPA			✓			
EURO.DIESEL (UK) Limited	✓					
Hitec Power Protection	✓					
Kohler UPS			✓			
Schneider Electric			✓			
Piller (UK) Limited	✓	✓				
Socomec Sicon			✓			
Vertiv			✓			
V40 Emergency Lighting	Central battery units	Luminaire conversion units	Central Test Equipment			
Chloride Safety Systems	✓					
Eaton	✓	✓	✓			
Existalite	✓	✓				
Etap			✓			
Fagerhult			✓			
Mike Stoane Lighting			✓			
Vertiv	✓					
V41 Street Lighting	Floodlighting	Street Area				
Aquila		✓				
Bega	✓					
Concord:marlin	✓					
DW Windsor		✓				
DZ-Licht	✓	✓				
Erco	✓					
Hess		✓				
Holophane		✓				
iGuzzini	✓	✓				
Light Projects	✓					
Louis Poulsen		✓				
Martin Architectural	✓					
Meyer	✓					
Philips	✓	✓				
Prisma	✓					
Reggiani		✓				
Sill Lighting	✓					
Thorn Lighting	✓	✓				
Trilux	✓	✓				
Urbis		✓				
We-ef	✓					
Whitecroft	✓					

A30schE – Schedule of Electrical Manufacturers

Equipment/Manufacturer	**Classification**					
Woodhouse UK plc		✓				
W10 Telecommunications	Emergency voice comms systems					
Sterdy Communications Limited	✓					
Baldwin and Boxall	✓					
W15 Facilities for the Disabled	Attendance Alarms					
Wandsworth Electrical	✓					
W40 Access Control	Access Control					
Casi	✓					
Cotag	✓					
PAC	✓					
Tyco Software House	✓					
C-CURE 9000	✓					
Lenel	✓					

A30schE – Schedule of Electrical Manufacturers

Equipment/Manufacturer	**Classification**					
W41 Security detection and alarm systems	Security Installers	CCTV	Alarms			
Airtech			✓			
Barrier	✓					
Baxall		✓				
Chubb	✓					
Dedicated Micros (Formerly: Dennard)		✓				
Ernitec		✓				
Eroplex			✓			
Galaxy			✓			
Grates	✓					
JVC		✓				
MAAS	✓					
Menvier Security			✓			
Bewator (Formerly: Molynx)		✓				
Norbain		✓				
Panasonic		✓				
Petards		✓				
Plettec		✓				
Pointer	✓					
Quadrant	✓					
Shawley		✓				
Synetics		✓				
Technology Solutions	✓					
Ultrak (Now owned by Honeywell)		✓				
Visimetrics		✓				
Welding Engineering Limited		✓				
W50 Fire Detection and Alarm	Control & Indicating Equipment	Fire detection & alarm systems	Fire Detect'n	Gas Systems	Emergency Voice Communicatio n Systems	
ADT Security Services Inc		✓				
Baldwin Boxall Communications					✓	
Gent Services (Owned by Honeywell)		✓				
Honeywell Control Systems		✓				
Kidde Fire Protection		✓				
Morley IAS Fire Systems (Owned by Honeywell)	✓					
Notifier (Owned by Honeywell)	✓	✓				
Siemans Buidling Technologies Ltd	✓	✓				
W51 Earthing and Bonding	Contractor Selection					
W52 Lightning protection	Earthing Components	Specialist Installer				

A30schE – Schedule of Electrical Manufacturers

Equipment/Manufacturer	**Classification**					
Erico Europa (GB)	✓					
Omega Earthing Systems		✓				
R C Cutting & Co		✓				
Furse (ABB)	✓					
W53 Electromagnetic Screening	Screening Systems	Surge protection devices				
Select only those firms who have confirmed ability to tender the works.	✓					
Eaton MEM	✓	✓				
Furse (ABB)		✓				
DEHN		✓				
W70 Structured Cabling	LAN Cabling	LAN Equipment	Cabinets	Home Network Cabinets		
CommScope (including TE and Krone systems)	✓					
BrandRex	✓					
HellermannTyton	✓					
Cisco		✓				
HP		✓				
Extreme		✓				
Other (For transceivers elements only)		✓				
Connectix				✓		
Canon Cabinets			✓			
Rittal			✓			
Y11 Metering	Elecric Meters	Energy Management System	Data Loggers	Controllers	Interfaces	IP Gateways
Schneider Electric	✓	✓	✓	✓	✓	✓
Y60 Conduit and Cable Trunking	Conduit	Service outlet boxes (Floorbox and Grommets)	Underfloor power distribtuion	Flexible conduit	Trunking general – metal	Trunking, general – non-metalic
Contractors Selection unless stated otherwise on schedules	✓				✓	✓
MK Power Distribution (Formerly Ackermann Limited)		✓				
Cableduct Limited					✓	
CMD Ltd		✓	✓			
Legrand		✓	✓		✓	
Electropatent Limited			✓			
Kopex International				✓		
MITA (UK) Limited (owned by Schneider Electric Limited)		✓				✓

A30schE – Schedule of Electrical Manufacturers

Equipment/Manufacturer	**Classification**					
Y61 Cables and Wiring	General (BASEC Approved)	Fire Rated Cables - BS EN 50200	Fire Rated Cables - BS 6387 CWZ	Fire Rated Cables - BS 7364-6	Pre-Fabricated Wiring Systems	Fire Rated Cables – BS 8491
Contractors Selection using BASEC Approved manufacturers, unless stated otherwise on schedules	✓					
AEI Cables		✓	✓	✓		✓
Apex Cables Limited					✓	
BICC General Pyrotenax Cabels Limited (MICC)		✓	✓			
Draka UK Limited	✓	✓	✓			✓
Prysmian (FP200 Gold, , FP600S) – Note : FP200 Gold is not suitable for use externally unless protected from UV.	✓	✓	✓	✓		✓
Wieland					✓	
Y63 Support Components – Cables	General	Cable baskets	Cable Ladder - metal	Cable Ladder – non-metallic	Cable Tray - metal	Cable pentration seals
Contractors Selection unless stated otherwise on schedules	✓				✓	
Cabofil UK Ltd (previously known as Greenings)		✓			✓	
Hawke International UK						✓
MITA (UK) Limited (Owned by: Schneider Electric Limited)				✓		
Philip Grahame International Limited		✓	✓		✓	
Swifts Legrand		✓	✓		✓	
WIBE			✓			
Y63 Support Components – Cables Continued	Cable Cleats	Junction Box IP68				
Ellis	✓					
CMP	✓					
Wiska		✓				

A30schE – Schedule of Electrical Manufacturers

Equipment/Manufacturer	**Classification**					
Y71 LV Switchgear & Distribution Boards	ACB's & MCCB's	Switches / Fused Disconnect-ors	Contactors	Final Distribution Boards	Fuses	LV Protection Relays
ABB Low Voltage Systems Limited	✓			✓		✓
Bill switchgear		✓				
Cooper Bussmann					✓	
Enbray			✓			
GE Power Controls (Formerly: GEC Alsthom)		✓			✓	✓
Eaton MEM		✓		✓		
MTE			✓			
Schneider Electric	✓	✓	✓	✓		✓
Socomec		✓				
Siemens	✓	✓	✓	✓		✓
Terasaki (Europe) Limited	✓					
Y71 LV Switchgear & Distribution Boards – Continued …	Switchboards / Assemblies <4,000A	Switchboards / Assemblies ≥4,000A	Computer Room PDU's	MCC's	Distribution Fuse Pillars	Power factor correction equipment
ABB Limited	✓	✓				✓
Alan Electrical	✓					
Blackburn Starling	✓			✓		
G K Switchgear	✓					
LUCY Switchgear					✓	
Main Systems Limited	✓					
Anord Mardix			✓			
Eaton MEM (Delta Electrical)	✓					✓
Rees Switchgear Limited	✓					
Sapphire Industrial Controls Limited	✓	✓				
Schneider LV Switchgear	✓				✓	✓
STS Switchgear and controls (Formely Spectar)	✓					

A30schE – Schedule of Electrical Manufacturers

Equipment/Manufacturer	**Classification**					
Y71 LV Switchgear & Distribution Boards – Continued …	Active Harmonic Conditioners	Battery Chargers and Battery Units	Automatic Transfer Switching Equipment (ATSE) Life Safety	Automatic Transfer Switching Equipment (ATSE) Non-life Safety	Static Switches	
ABB Limited	✓		✓			
Asco (Owned by Schneider Electric)			✓			
PB Design and Development Limited		✓				
Schneider Electric	✓			✓		
PB Design and Development Limited		✓				
Socomec				✓	✓	
Vertiv					✓	
LPC approved device for spirnkler pumps			✓			
Y72 Contactors & Starters	General	Variable Frequ'cy Inverters				
Contractors selection for incorpor-ation into Y71.						
ABB Limited		✓				
Danfoss		✓				
Mitsubish Electric		✓				
Telemecanique (Owned by; Schneider Electric Ltd)		✓				
Siemens		✓				
Y73 Luminaires and Lamps	Luminaires and Lamps	Dimming Equipment	Interior - Suspended Flourescent	Interior - General	Interior - Display and Decorative	Track Lighting
Refer to Luminaire Schedule.	✓					
ERCO Lighting Limited	✓	✓				
iLight Limited	✓	✓				
Leax Lighting Controls	✓	✓				
Concord Lighting	✓					✓
iGuzzini Illuminazione (UK) Ltd					✓	✓
IBL Lighting Limited	✓					
Mode Lighting (UK) Limited						
BLV Licht und Vakuumtechnik GmbH	✓					
OSRAM Limited	✓					
Holophane Lighting	✓					

A30schE – Schedule of Electrical Manufacturers

Equipment/Manufacturer	**Classification**					
GE UK Lighting	✓					
Zumtobel Staff Lighting Limited	✓			✓		
WILA Lighting Limited	✓			✓	✓	
Philips Lighting				✓		
Marlin Lighting Limited	✓					
Fagerhult Lighting Limited			✓			
Lightform Limited	✓					
					Interior - Custom Designed	Transformers for Extra Low Voltage Lamps
Lightform Limited					✓	
Mode Lighting (UK) Limited						✓
IBL Lighting Limited						✓
Y74 Accessories for Electrical Services	Wiring Access'	Relays	Meters	Time Switches	Isolating Transform-ers for laboratories	110V Plantroom Outlets
Blakley Electrics Limited					✓	✓
Clipsal Limited	✓					
Electrium (Crabtree, Wylex & Britmac)	✓					
MEM 250, Delta Electrical Limited	✓					
MK Electric Ltd	✓					
Sangamo				✓		
Schneider Electric	✓					
Wandsworth Electrical	✓					
Y74 Accessories for Electrical Services						
Y81 Testing and Commissioning Contractor to employ commissioning specialist where appropriate.						
Y92 Motor drives – Electric Contractors selection.						

A30schM – Schedule of Mechanical Manufacturers

Equipment	Manufacturer
N 20 Packaged Plant rooms	Armstrong Integrated Systems Constant Air Systems Ellison Engineering Services / Ellison Packaged Plant Ormandy Ltd Platignum Environmental Ltd
R10 Rainwater Pipework/Gutters	Contractors selection, unless stated otherwise on schedules
R11 Foul Drainage above Ground	Contractors selection unless stated otherwise on schedules or in scope or work. Air admitance valves - Studor
R12 Foul Drainage below Ground	Contractors selection unless stated otherwise on schedules or in scope or work.
S10 Cold water (flowmeters)	Elster Metering (formerly Kent Meters) ABB Metering Ltd. Switch2 Energy Solutions Ltd. (Formerly Viterra Energy Services)
S10 Cold water (Packaged Category 5 units)	(Combined booster set, tank and controller) Arrow Valves New Haden Pumps Kemper Aquatech Pressmain
S11 Hot water	Heaters ACV UK Ltd (tank in tank hot water storage heaters) Advance Services Ltd (AO Smith) Andrews Water Heaters (Part of the Baxi Commercial Division) Applied Energy Products Ltd (Redring water heaters & showers) Heatrae Sadia (Part of the Baxi Group) Lochinvar Zip Heaters (UK) Rinnai Rycroft (Part of the Ormandy Group) HRS Hevac Ltd
S20 Treated/Dionised/Distilled Water	**Hypochlorous Acid dosing systems** Clearwater Technology Ltd. Ultralox **Water Conditioners (non chemical)** Goodwater Hydrotec Liff Industries The Rodin Group Ltd. (Scale –Buster)
S60 **S70 Fire Fighting**	Chubb Kidde Fire Protection Siemens Building Technologies Ltd. Surefire Systems Ltd. Tyco Fire Systems

A30schM – Schedule of Mechanical Manufacturers

Equipment	Manufacturer
T14 Heat Pumps **(Ground source / air to water)**	Ciat Calorex De'Longhi (ICS Heat Pumps) Climaveneta (ICS Heat Pumps) Clivet Kensa Engineering Swegon (Coolmation/Blue-Box) Viessmann Ground collector probes Rehau
T31 Heat Emitters	Radiators Dimplex Bisque Commercial Contour Casings (LST radiators and guards) Hudevad Jaga MHS Radiators Myson Radiators (Part of Rettig group) Stelrad Radiators Quinn (Merroit) Zehnder Ltd. (inc. Runtal & Thermal Radiators) Convectors Dimplex Biddle Air Systems Dunham Bush Jaga Kampmann HCP Zehnder Trench Heating Dunham Bush Kampmann HCP Radiant Heaters (LTHW & Electric) Comyn Ching & Co (Solray) Frenger Systems Ltd. Internal Climate Control (Heat Profile) Bisque Commercial HCP Underfloor Heating Ambiente J.G Speedfit Multibeton PIPE2000 Ltd. Rehau Ultimate Underfloor Heating Wirsbo (Uponor)
T50 Heat Recovery	Dantherm Ltd. Nuaire PM Luft Thermal Technology Sales Ltd.

A30schM – Schedule of Mechanical Manufacturers

Equipment	Manufacturer
	Xpelair (part of Applied Energy Products Ltd) Vent Axia DX based packaged heat recovery units Clivet
T70 Local cooling units	Refer to U 60 or U 41
U10 Ventilation Refer to relevant Y sections for mechanical ventilation plant	Natural (Passive / mixed mode) air inlet / outlet terminals Passivent Aereco Nuaire Ground – Air heat Exchangers Rehau Demand control air-handling system Swegon
U14 Smoke extract	Refer to scope of works and schedule
U41 Fan Coil Units	Fläkt Woods Ability Advanced Air AEUK Aermec Benson Environmental Biddle Air Systems Clivet (including reverse-cycle heat-pumps) Colman Moducel Diffusion Group – (Part of Energy Technique PLC) Dunham-Bush Lennox Industries (air side control) Smiths Fan Coils Carrier Trox
U60 Air conditioning	Computer room units Clivet Denco Emerson Climate Technology (formerly Liebert Hiross Ltd.) Stulz UK Ltd. Swegon Bluebox Uniflair Air Conditioning DX spits / VRV (T62) / Heat Pumps AEUK Aermec Airedale International Clivet Daikin Air Conditioning UK Ltd ICS Heat Pumps (sole agent for De'Longhi) Marstair (Divion of TEV Ltd) Mitsubishi Electric Mitsubishi Heavy Industries Samsung (manufacturer) (sold as Vent Axia units) Toshiba Walter Meier (Climate UK) (Hitachi)
W54 Liquid Detection Alarm	Andel PPL Aquillar (Master distributor for Tyco Tracetek) Aqualeak Jam (Aqualarm)

A30schM – Schedule of Mechanical Manufacturers

Equipment	Manufacturer
W60 Controls/Monitoring	TAC / Satchwell – (Owned by Schneider Electric) Trend Control Systems Ltd. (Only System Houses who are Trend TTC's or SI's will be will be considered acceptable) Honeywell Control Systems Johnsons Control Systems Sauter Automation Ltd. Siemens Building Technologies (Building Automation) Trane UK Ltd. (Building Management Systems) Cylon Controls
Y10 Pipes, Fittings & Accessories Listed here are manufacturers of specialist systems / equipment. General service pipework to be Contractors selection unless stated otherwise on schedules.	Specialist Pipework Systems Pegler Yorkshire pressfit Geberit Mapress (press-fit system) Victaulic grooved system Viega pressfit range - Profipress (copper), Sanpress Inox (stainless steel), Smartpress (MLCP), Megapress (steel) SAV UK Ltd. (plastic coated aluminium pipe for final run outs to terminals) TYCO Building Services Products (Grinell grooved system) Omegaflex ("TracPipe") Corrugated Stainless Steel Tube for natural gas to BS EN 15266 Underground pre-insulated pipe systems Flexenergy heating and cooling products (PB) Flexalen Durotan Ltd.(PE-Xa / Steel) REHAU (PE-Xa) Watts Industries (Microflex PE-Xa) Vital Energi (Steel) Other Special Fittings Guyson International (Hansen quick release hose couplings) Aquaflow Regulators Ltd. (flow regulators / restrictors in hot and cold water systems)
Y10 Support Systems Contractors selection unless stated otherwise on schedules	Extensis Ltd. IHL (Industrial Hangers Ltd.) Walraven Roof Pro Unistrut
Y11 Valves / Strainers	General service and commissioning Pegler Yorkshire (Broen commissioning valves and PICV's) Crane Frese Hattersley Herz valves Marflow Hydronic Systems Flowcon TA Hydronics (Tour & Andersson) Oventrop SAV UK Ltd. Manifold Commissioning Systems SAV Crane Hattersley Herz valves Marflow Hydronic Systems TA Hydronics (Tour & Andersson) Differential pressure, high limit, flow control, PICV, and other

Equipment	Manufacturer
	Crane Danfoss Randall Frese Flowcon Hattersley Herz valves Pegler Yorkshire Honeywell Control Products Marflow Hydronic Systems Oventrop Samson Controls Spirax Sarco SAV UK Ltd. TA Hydronics (Tour & Andersson) General Control valves + TRV's Crane Frese Hattersley Herz valves Oventrop Pegler Yorkshire Broen Aquaflow Regulators Ltd. (flow restrictors) Safety / Pressure relief Bailey Birkett (Safety Systems UK Ltd.) Nabic Valves (Delta Fluid Products Ltd.) Spirax Sarco Specialist Valves Applied Energy Products Ltd (Redring thermostatic mixing etc) Aquatech Pressmain (Priority Demand Valve for domestic sprinklers, Combination Surge Arrestor and Air Release Valve) Caleffi (thermostatic mixing) Cla-val Crane Donkin Gas Valves Ltd. Hattersley Herz valves (Thermostatic mixing, pressure regulating /reducing, return water temperature controller, preassembled manifold commissioning units) Honeywell ACS Control Products/Braukmann (Thermostatic mixing, pressure regulating /reducing, back flow prevention, thermal balancing / disinfection for HWS) Hopkinsons (Steam) Horne Engineering (thermostatic mixing) Kemper (Thermostatic mixing, pressure regulating /reducing, back flow prevention, thermal balancing) Reliance Water Controls (thermostatic mixing) Safi (Chemical / corrosion resistant) Landon Kingsway – (Gas/oil shut off) Alcon Solenoid Valves – (Gas/oil/water shut off)

Equipment	Manufacturer
	Watts Industries (thermostatic mixing, pressure regulating,backflow prevention)
Y11 Expansion Bellows and flexible connections	Boa Flexible Solutions Ltd Isolated Systems Ltd. J & P supplies Ltd. N Minikin & Sons Superflex (Interflex)
Y11 filters, dirt separators, deaerators	Carter Environmental (filters) Engineering appliances Ltd (dirt separators / deaerators) Lubron Water Technologies Plenty Filters (filters) Spirotech (UK) Ltd. (dirt separators / deaerators)
Y11 Heat Meters	Switch2 Energy Solutions Ltd (Formerly Viterra Energy Services) Danfoss Coster
Y20 Pumps	**Glandless In Line** Armstrong Grundfos Lowra (UK) Ltd. Smedegaard Pumps Ltd. Wilo (UK) Ltd. **Centrifugal** Armstrong DAB pumps Grundfos Lowra (UK) Ltd. Wilo (UK) Ltd. KSB **Pressurisation Units** Armstrong KGN Pillinger Mikrofill Smedegaard Pumps Ltd. **Packaged Booster sets BCWS** Allan Aqua Systems Aquatec Pressmain Armstrong KGN Pillinger Grundfos Lowara (UK) Ltd. Smedegaard Pumps Ltd. Wilo (UK) Ltd. **In-line Mains pump** Stuart Turner Grundfos Salamander For CAT5 units refer to S10
Y21 Water Tanks / cold water storage control	AC Plastic Industries Balmoral Group Ltd. Braithwaite Engineers Dewey Water Nicholson Plastics

Equipment	Manufacturer
	Sarena mfg Ltd. Keraflo (Electronic tank management systems for cold water storage control)
Y24 Trace Heating	Isopad nVent/Raychem Thermon (UK) Ltd.
Y25 Cleaning and Chemical Treatment	Aquatreat Chemicals Barfield Water Treatments and Commissioning Services 2003 Clearwater Technology Ltd Water Technology Waterwise Technology Ltd
Y30 **Y31 Air Ductlines/Dampers**	Ductwork Hotchkiss Senior Hargreaves Galloway Group Lindab Specialist ducts Fire Protection Ltd (flamebar fire resistant ductwork) Rega Ductex (flexible acoustic ductwork) Fabricair (textile ducts) KE Fibretec UK (textile ducts) Kingspan (Koolduct pre-insulated ductwork) Dampers Actionair Group Advanced Air BSB Engineering Trox Quelfire (intumescent collars) Lorient Polyproducts Ltd. (intumescent fire dampers)
Y41 Fans and Roof Units	Centrifugal Flakt Woods Helios Ventilation Systems Ltd UK Kiloheat Matthews and Yates Nuaire Axial Elta Fans Helios Ventilation Systems Ltd UK Nuaire Flakt Woods Twin Fan units, Duct mounted in line centrifugal & Mixed flow Elta Fans Helios Ventilation Systems Ltd UK Nuaire Vent Axia / Roof Units Group Xpelair (Part of Applied Energy Products Ltd) Plastic Central Fans (Colasit) Fumeair Parsons Plastics

A30schM – Schedule of Mechanical Manufacturers

Equipment	Manufacturer
	Wall/window/inline Helios Ventilation Systems Ltd UK Vent Axia Xpelair Car Park Extract Jet / impulse fans Colt International – jetstream or impulse fans Flakt Woods – jet fans Nuaire PSB Ventilation – impulse fans Other special fans Exhausto *(chimney fans and flue dilution systems)*
Y42 Air Filters	AAF International Farr McLeod russel (Vokes/Luwa) Trox
Y45 Attenuators/Acoustic Treatment	Allaway Acoustics Industrial Acoustics Co. Trox Brothers Ltd. Galloway Acoustics
Y46 Grilles/Diffusers/Louvres	Advanced Air Gilberts Ltd. Halton Products Motorised Air Products Krantz Koolair (UK) Ltd. Schako Trox (UK) Ltd. Waterloo Air Management
Y50 Thermal Insulation Contractors selection of installation specialist	Insulation Manufacturers Armacell UK GRM Distribution Ltd. Isover (Saint-Gobain) Kingspan Tarec Knauf NMC (UK) Ltd. Neville Thompson (Isogenopak cladding) Rockwool Saint-Gobain Isover Venture Tape Europe (Ventureclad self adhesive laminated foil film) Fire Protection Cladding systems Promat “Vicuclad” board cladding Rockwool “Fire Duct” Fire protection board cladding Saint Gobain Isover “U- Protect” slab and flexible wired mat
Y51 Testing and Commissioning	Contractor to select specialist who must be a member of The Commissioning Specialists Association (CSA)
Y52 Vibration Isolation Mountings	Industrial Acoustic Company Ltd. Chrisie and Grey Mason (UK) Ltd. Isolated Systems Ltd.
Y53 Control Components	Aercon (Power Utilities Ltd.) room - pressure controls

A30schM – Schedule of Mechanical Manufacturers

Equipment	Manufacturer
	Invensys Climate Control (Drayton) CMR Controls (room pressure controls) Danfoss Randall Ltd. Honeywell Control Systems Siemens Building Technologies West Energy Saving Technologies Ltd. (Innovative ventilation controls direct Acting by current sensing cookers & other electrical appliances, Thermistor sensor to dead leg of bath or shower). Oliver IGD Ltd. (Gas Detection and Gas Analysis Products) Murco (gas detection)

Should a Contractor propose an alternative manufacturer to those listed in this schedule, then the standard FM procedure should be followed as defined in the following document PROCEDURE FOR ALTERNATIVE MANUFACTURERS

A30schX – Schedule of Lift, Hoist and Lifting Equipment Manufacturers

Equipment/Manufacturer	Classification
X10 Lifts ***Select only those firms who have confirmed ability to tender the works.*** Alimak Ltd Apex Ltd Associated Lift Services (ALS) Bardeck Lifts Fujitec UK Ltd Guideline Kone Lifts Ltd Landmark Lifts Ltd Otis plc PickeringsLifts Schindler Ltd Stannah Lifts Ltd Thyssen Lifts and Escalators Ltd	See Guidance Note

Guidance Note

The above is a list of AECOM's preferred manufacturers of building services plant. whose details have been updated and indexed on the Building Services Preferred Manufacturers Database on Inform They are presented here to help the generation of the Schedule of Manufacturers. The project team must decide which manufacturers products are relevant to the project and delete those that are not.

Where the design has been based upon a specific manufacturer's product underline that manufacturer in the list. Where not based on any particular product, underline non

Whilst we will normally indicate a typical manufacturer in no instance should we provide a manufacturer's or supplier's reference which actually gives the model sizing. Equally only after a formal pre tender exercise, are we to make reference to manufacturers quotations.

Should a Contractor propose an alternative manufacturer to those listed in this schedule, then the standard FM procedure should be followed as defined in the following document PROCEDURE FOR ALTERNATIVE MANUFACTURERS

Notes:

1. The following schedule has been developed from Appendix A in BSRIA BG 6/2018 (This is licensed to AECOM).
2. The schedule is based on the tender documentation having been developed generally to part way through RIBA Plan of Work 2013 stage 4 (Technical Design)
3. Where changes have been made to the standard wording in the BSRIA guide or additional items or comments have been added they are indicated in underlined italics. Where item numbers are not consecutive this indicates where an original BSRIA item has not been used. New items have been allocated ref numbers that do not conflict with the standard BSRIA numbering.
4. The schedule shall be read in conjunction with the complete specification and drawings. In particular refer to work sections A31 for definitions and interpretations of tender documents and A37 for details of record documentation required and operation and maintenance of the building. NB
5. The schedule does not detail every design activity required during the Contract, or include all items from BSRIA BG6/2018. It is intended to highlight aspects of the design and construction process where there may be confusion over who is responsible for certain activities. The absence of a design activity does not imply it is not required on the project. The sequence of activities in each stage is not implied by the sub-heading order or the order of activities.
6. Should any activity clash with other contractual information, inform the Contract Administrator during the tender period
7. In this schedule “Designer” means AECOM; “Installer” means “Services Sub-Contractor” or “Contractor” depending on the Contract.
8. The RIBA stages refer to RIBA plan of work 2013

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PROFORMA 4: TECHNICAL DESIGN (RIBA STAGE 4)

Some activities in RIBA Stage 4 may continue after the start of the project's construction stage.

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Ref	Design activity in connection with building services	Allocated to … L=Lead, S=Support, R=Review						Comments
		A	B	C	D	E	Z	
	General obligations, external liaison (statutory bodies, utilities)							
4.1.1	Carry out ongoing checks for compliance with regulations.	L						
4.1.2	Advise on impact of any changes from scheme used to calculate the Building Emissions Rate for Building Regulations energy compliance and (if relevant) EPC.	L						Could be same party that led earlier calculation
4.1.3	Provide information for pre-site building control approval.	L						
4.1.4	Obtain final quotations for incoming services based on final agreed building loads.	R					L	Define extent of incoming services
4.1.5	Seek utility company comments on the spatial requirements and builders' work associated with the provision of incoming services.					L		
	Client liaison (briefing, handover, surveys)							
4.2.1	Prepare the building services Employers Information Requirements in accordance with BS EN ISO 19650-1 / BS EN ISO 19650-2.						L	As per BS EN ISO 19650-1 / BS EN ISO 19650-2
4.2.2	~~Prepare pre-contract BIM Execution Plan for building services installation (as required by procurement route).~~							~~As per BS EN ISO 19650-1 / BS EN ISO 19650-2~~
4.2.3	Advise on an appropriate method of procuring maintenance expertise.		L		S			
4.2.4	Define the scope and content of operating and maintenance manuals appropriate for the project.	L						
4.2.5	Review the design against operational design targets, involving the future building manager(s) ~~and update/reissue design reports, specifications and/or Soft Landings reports.~~	L						
4.2.6	Define the requirement for handover information.	L					S	
4.2.7	Specify form of delivery and method of production of handover information.	R					L	Take account of any phased handover or partial possession
4.2.8	Prior to commencement of works, prepare method statement for the maintenance of existing services.		L					
	Team liaison (builders' work, spatial coordination, energy targeting)							
4.3.1	Undertake checks in relation to Building Regulations energy performance compliance and (if relevant) EPC criteria.	L						
4.3.2	Review proposals from others in relation to Building Regulations energy performance compliance and (if relevant) EPC criteria.	L	S					
4.3.3	Review dimensional and other numerical tolerances to be applied to building services design and deliverables at different project stages.	L	S		S			
4.3.4	Make submissions to obtain Building Regulations approval in relation to energy performance.	L		S				
4.3.5	Design weatherproofing details for all services passing through external elements of the building.	S	S	L	S			

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		A	B	C	D	E	Z	
4.3.6	Provide typical details for all acoustic stopping for services penetrating builders' work elements.	S	S	L	S			
4.3.7	~~Develop and update BIM Execution Plan during project.~~							~~As per BS EN ISO 19650-1 / BS EN ISO 19650-2.~~
4.3.8	Develop and update building services Task Information Delivery Plan.	L						As per BS EN ISO 19650-1 / BS EN ISO 19650-2.
4.3.9	Develop and update Master Information Delivery Plan during project.	S		S		S	L	As per BS EN ISO 19650-1 / BS EN ISO 19650-2
4.3.10	~~Federate information models from separate task teams and oversee the clash avoidance process.~~							~~As per BS EN ISO 19650-1 / BS EN ISO 19650-2~~
4.3.11	Carry out project-wide design review of feasible-generic design.	L						See section 3.8 of BG 6
4.3.12	Agree the principles relating to reflected ceiling plans.	S		L				
4.3.13	Carry out Stage 4 coordination between building services, structure and architecture prior to selection or procurement of actual equipment. (Feasible for building services contractor/ trade-contractor pricing and installation without major re-routing).	L		S				Major spaces: plant rooms, risers, ceiling and floor voids. Removal of critical clashes – see section 2.5 of BG 6
4.3.14	Carry out Stage 4 coordination between different building services prior to selection or procurement of actual equipment. (Feasible for building services contractor/trade contractor pricing and installation without major re-routing).	L			S			Removal of critical clashes – see section 2.5 of BG 6
4.3.15	Consider requirements for cable pulling (routes and anchor points).	R	L					
4.3.16	Review design risk assessments incorporating specialist design input.	R	L		S			Specify extent of risk assessments (H&S, technical, commercial)
4.3.17	Check the provision for and adequacy of builders' work information provided for specialist elements (including CDP).	R	L		S			
4.3.18	Select and detail sleeves, inserts, frames, and fixing anchors, and any other items required to be cast or built into the structures by others, including coordination of positions to such extent and accuracy to allow structural construction to proceed.	R	L					
4.3.19	Detail and coordinate all access platforms, stairs, rails and protection elements required for future maintenance and operation of plant/equipment.	R	L	R				
4.3.20	Carry out final detailed location and dimensioning of 2nd fix equipment based on architectural information.	R	L	R				State extent (luminaires, control devices, outlets, and grilles)
4.3.21	Determine location of access panels.	R	L	R				For example, rodding eyes and pipework valves
4.3.22	Carry out project-wide design review of coordinated-generic design.	S	S	L				See section 3.8 of BG 6

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Ref	Design activity in connection with building services	Allocated to … L=Lead, S=Support, R=Review						Comments
		A	B	C	D	E	Z	
4.3.23	Confirm builders' work information for specified equipment or materials, or where alternatives to those provisionally or pre-selected are agreed.	R	L					Bases, supports and structurally significant holes
4.3.24	Provide final details for all acoustic stopping for services penetrating builders' work elements.	R	L					
4.3.25	Carry out Stage 4 coordination between all building services trade contractors after the selection or procurement of actual equipment.	R	L		S			Removal of critical clashes – see section 2.5 of BG 6
4.3.26	Carry out Stage 4 coordination between the building services, structure and architecture after the selection or procurement of actual equipment.	R	L		S			Removal of critical clashes – see section 2.5 of BG 6
4.3.27	Prepare detailed construction programme for installation and remaining design activities.	R	L		S			
4.3.28	Carry out project-wide design review of coordinated-specific design.		L		S			See section 3.8 of BG 6
	Selection of plant and specialist designers							
4.4.1	Develop initial technical design for systems to be procured as Contractor Design Portions (where building services contractor not already appointed).	L						
4.4.2	Advise of significant allowances or constraints incorporated in the main design that may affect the specialist design.	L						
4.4.3	Obtain indicative quotations for plant not requiring specialist design.	L						
4.4.4	Review that all plant and equipment incorporated into the works can be safely maintained and accessed in compliance with current legislation.	L	S		S			
4.4.5	Check plant and system sizing once Stage 4 coordination of the works has been undertaken with selected or procured equipment (4.3.25).	R	L		S			Removal of critical clashes – see section 2.5 of BG 6
4.4.6	Select plant, equipment, components and material to meet the specified performance. Where items or manufacturers differ from provisional selections ensure they are fully compatible with all the other system parameters, components and design requirements.	R	L		S			
4.4.7	Advise whether the proposed alternative items or manufacturers comply with the selection criteria.	L	S		S			
4.4.8	Advise whether the proposed alternative items or manufacturers are acceptable.	L	S					
4.4.9	Re-evaluate all parts of the services design which may be affected by acceptance of alternative items or manufacturers.	S	L					
4.4.10	Re-evaluate all parts of the architectural or structural design which may be affected by acceptance of alternative items or manufacturers.	S	L	S				

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		A	B	C	D	E	Z	
4.4.11	Amend the building services design to incorporate agreed alternative items or manufacturers.	S	L	S				
4.4.12	Prior to confirming agreed final fixed costs with the client, agree final equipment selections and manufacturers.	S	L					
4.4.13	Monitor the specialist design input for compliance with the design intent.	L	S					
4.4.14	Evaluate the impact of the specialist design on those parts of the overall design that are provisional.	S	L					
4.4.15	Monitor the ongoing progress of the procurement, manufacture, installation and commissioning of all plant items.	S	L		S			
4.4.16	Review all plant and equipment incorporated into the works with respect to safe maintenance and access in compliance with current legislation.	S	L		S			
	Mechanical design							
4.5.1	~~Determine parameters of flues to incorporate the requirements of the plant manufacturer, building control, environmental health officer and current legislation such as the Clean Air Act.~~							
4.5.2	Finalise detailed design calculations for all mechanical services being included in the technical design in accordance with recognised national standards.	R	L		S			See Appendix B for specific services
4.5.3	Determine detailed flue, duct and pipe sizes and routes.	R	L		S			
4.5.4	Following equipment procurement, modify distribution systems and equipment capacities as may be required as a result of coordination (4.3.25).	R	L		S			
4.5.5	Design all necessary facilities for flushing, and commissioning.	R	L		S			
4.5.6	Size, select and determine final locations of commissioning sets based on coordination of procured equipment (4.3.25).	R	L		S			
4.5.7	Carry out final sizing of sections of ductwork between terminal units and diffusers to ensure the specified acoustic criteria and duct velocities.	R	L		S			
4.5.8	Carry out final detailing and confirm the location and sizes of duct connections to external louvres.	R	L		S			
4.5.9	Carry out detailed design of anchors, guides and other provision for movement of services and systems due to thermal expansion and contraction and building movement.	R	L		S			
4.5.10	Check fan and pump system resistances based on coordination of procured equipment (4.3.25).	R	L		S			Suggest checker is independent person from selector
4.5.11	Check system water capacities and quantities of chemical additives based on the final equipment selection.	R	L		S			Suggest checker is independent person from selector

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		A	B	C	D	E	Z	
4.5.12	Carry out final detailing of drain and vent points.	R	L					
4.5.13	Carry out final selection of all terminal devices.	R	L					
4.5.14	Carry out final selection of pressurisation units and expansion vessels.	R	L					
4.5.15	Detailed design and sizing of refrigerant pipework between items of equipment provided under the contract works based on the final equipment selection and coordinated working drawings.	R	L					
4.5.16	Select and confirm location of fire dampers and any other fire-stopping for mechanical systems.	R	L					
4.5.17	Select and confirm location of control dampers and control valves to achieve the specified function and to suit the characteristics of items served and final system configurations based on the final equipment selection and coordinated working drawings.	R	L					
4.5.18	Carry out final selection of control valves to suit pipework and authority of controls based on final installation drawings.	R	L					
4.5.19	Carry out final selection of all anti-vibration mountings.	R	L					
4.5.20	Design review.	L	S					See section 3.8 of BG 6
	Electrical design							
4.6.1	Finalise detailed design calculations for all electrical services being included in the technical design in accordance with recognised national standards.	R	L					See Appendix B for specific services
4.6.2	Determine detailed cable and containment sizes, switchgear sizes and locations, control panel locations, user equipment sizes and locations, and sensor locations for small power, lighting, high voltage systems, and metering.	R	L					
4.6.3	Determine approximate sensor locations, control panel locations for fire safety and security systems.	R	L					
4.6.4	Design automatic controls systems as required to meet the operational, functional and spatial requirements of the specification.	R	L					
4.6.5	Determine control strategy for lighting.	L	S					
4.6.6	Design fixing, connection, earthing and bonding details as required for final installation of lightning protection systems.	R	L					
4.6.7	Modify distribution systems and equipment capacities as may be required as a result of Stage 4 coordination with intended or procured equipment.	R	L					
4.6.8	Verify spatial requirements for cable pulling and installation.	R	L					
4.6.9	Verify cable sizes for primary electrical supply based on coordination of procured equipment (4.3.25) and cable lengths.	R	L					

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		A	B	C	D	E	Z	
4.6.10	Verify cable sizes for specialist systems based on coordination of procured equipment (4.3.25) and cable lengths.	R	L					Such as fire alarm, datacomms, CCTV, and access control
4.6.11	Select and confirm location of fire-stopping for electrical systems.	R	L					
4.6.12	Check control panel cable entry and exits are possible in the final location and that safe operating and maintenance clearances are provided.	R	L					
4.6.13	Check compatibility of building services plant and equipment with the controls systems.	R	L					
4.6.14	Carry out design and incorporation of all interfaces (including relays or other devices or modifications to hardware or software).	R	L					
4.6.15	Incorporate final information for electrical systems into the design via schedules or BIM objects, including control addresses for lighting and fire alarm systems, BMS points.	R	L					
4.6.16	Design review.	L	S					See section 3.8 of BG 6
	Public health design							
4.7.1	Finalise detailed design calculations for all public health services being included in the technical design in accordance with recognised national standards.	R	L					See Appendix B for specific services
4.7.2	Determine detailed pipe sizes and routes for gravity and pumped drainage systems.	R	L					
4.7.3	Determine final positions of cast-in drainage gullies ensuring coordination with structural design and final mechanical plant locations.	R	L					
4.7.4	Finalise vent termination locations to coordinate around final air vent intake positions.	R	L					
4.7.5	Determine final power, BMS/Controls interface requirements from equipment.	R	L					
4.7.6	Coordinate all surface water domestic and waste water pipework rodding eye locations with other services, structural and architectural elements to ensure suitable maintenance access can be provided.	R	L	S				
4.7.7	Verify storm water discharge flow rate satisfies planning and statutory authority requirements including SuDS.					L		
4.7.8	Determine detailed routing of pipework and drainage to/from risers.	R	L					
4.7.9	Carry out detailed design of pipework gradients for builders' work and coordination.	R	L					Includes domestic and waste drainage (gravity/pumped), surface drainage and condensate runs
4.7.10	Modify distribution systems and equipment capacities as may be required based on coordination of procured equipment (4.3.25).	R	L					

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		A	B	C	D	E	Z	
4.7.11	Make allowance for anchors, guides and provision for movement of services and systems due to thermal expansion and contraction and building movement.	R	L					
4.7.12	Select and confirm location of fire collars and any other fire-stopping for public health systems.	R	L					
4.7.13	Check all surface water, domestic and waste drainage discharge flow rates with external civils interface package.	R	L					
4.7.14	Check all utility interface details (locations, pipe sizes and invert levels) with civils package to ensure internal and external services coordinate.	R	L					
4.7.15	Design review.	L	S					See section 3.8 of BG 6
	Commissioning							
4.8.1	Review all designs to ensure that systems are commissionable.	R	L		S			
4.8.2	Determine witnessing and commissioning requirements for items installed on site.	L	S		S			Other than those covered by 3.8.2
4.8.3	Identify and incorporate into system designs the essential components and features necessary to enable the proper commissioning of building services (including preparation).	L	S		S			For example, including test points
4.8.4	Review the commissioning plan.	L	S		S		S	
4.8.5	Update the commissioning plan.	S	L		S			
4.8.6	Review proposals and method statements from prospective commissioning specialist(s).		L					
4.8.7	Finalise location of test points.		L		S			
4.8.8	Appoint an independent specialist commissioning contractor responsible for testing and commissioning.		L		S			See also 3.8.4
	Deliverables – including drawings, specifications, reports							
4.9.1	~~Provide a technical design report up to the level of feasible-generic components and equipment, as an update to the Developed Design Stage 3 report~~							
4.9.2	Provide health and safety risk assessments for the design.	L						
4.9.3	~~Provide an approximate cost plan using feasible-generic components and equipment for mechanical, electrical and public health services based on floor area, building type and typical system type or other agreed approximate methodology.~~							
4.9.4	Provide any information that is required in connection with any application for planning permission including reviews and/or appeals where applicable.	L						
4.9.5	Provide updated estimate of regulated [RP] in-use energy consumption.		L		S			

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		A	B	C	D	E	Z	
4.9.6	~~Provide updated assessment of comfort conditions and overheating risk~~							
4.9.7	~~Provide updated report on adequacy of existing mechanical, electrical and public health services to incorporate extended or refurbished works.~~							Agree level of further intrusion and physical testing if applicable
4.9.8	~~Provide technical design or performance information and specifications to modify, refurbish or replace existing mechanical, electrical and public health engineering services and plant to incorporate new and extended engineering services.~~							
4.9.9	Provide tender documentation for inclusion in a tender package if the procurement method requires it.	L						See also 2.9.6 and 3.9.24
4.9.10	~~Provide report on proposals or agreed outcomes following participation in any Soft Landings process.~~							
4.9.11	~~Provide information for detailed whole-life cost studies.~~							
4.9.12	~~Provide information to the Environmental Assessment Method Assessor to allow credits to be checked and awarded.~~							
4.9.13	Provide specifications for final commissioning and handover.	R	L		S			
4.9.14	Provide detailed commissioning plan.	R	L		S			
4.9.15	Provide information for Construction Phase Plan as per CDM Regulations.	R	L		S			
4.9.16	Provide calculations and/or software files as evidence of Technical Design model and/or drawings.	R	L					Agree format
4.9.17	Provide schedules to cross-reference cables to containment systems.		L					
4.9.18	~~Provide technical design model in line with defined level of clash resolution and agreed tolerances.~~							Using generic objects, feasible to price and to install without major re-routing
4.9.19	Provide Technical Design drawings.	L						
4.9.20	Provide Technical Design schematics.	L						
4.9.21	Provide updated schedule/drawings of builders' work information based on technical design information.	L						
4.9.22	Produce materials and workmanship specifications.	L						
4.9.23	Produce performance specifications for specialist designed elements of the works.	L						
4.9.24	Produce equipment schedules.	L	S					
4.9.25	Provide design stage information towards log book and/or building user guide(s).	S	L					
4.9.26	Provide mechanical, electrical and public health information necessary to obtain statutory approvals.	L						

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PROFORMA 4: TECHNICAL DESIGN (RIBA STAGE 4)
Some activities in RIBA Stage 4 may continue after the start of the project's construction stage.
Reproduced from BSRIA BG 6/2018 A Design Framework for Building Services 5th edition

Ref	Design activity in connection with building services	Allocated to … L=Lead, S=Support, R=Review						Comments
		A	B	C	D	E	Z	
4.9.27	Provide detailed specifications for mechanical, electrical, public health services, if relevant.	S	L					
4.9.28	Sign off detailed specifications.	L	S					
4.9.29	Contribute to draft construction programme for the project.	R	L					
4.9.30	Produce Construction Phase Plan before work starts on site, as per CDM Regulations.		L					
4.9.31	~~Provide updated Technical Design model.~~							~~Using generic objects and coordinated to demonstrate resolution of clashes between architecture, structure and services in line with level of clash resolution and agreed tolerances.~~
4.9.32	Provide building services coordinated working drawings.	R	L					State whether for generic or specific (agreed/procured) equipment.
4.9.33	Provide coordinated reflected ceiling plans based on agreed architectural information for all components.	R	L			R		
4.9.34	Provide coordinated room elevations based on agreed architectural information for all components.	R	L			R		
4.9.35	Provide detailed cost plan.		L					
4.9.36	Provide final construction programme.		L					
4.9.37	Provide detailed commissioning programme.		L					
4.9.38	~~Provide updated Technical Design model with revised or new design details.~~							~~Using specific objects and coordinated to demonstate resolution of clashes between architecture, structure and services in line with level of clash resolution and agreed tolerances.~~
4.9.39	Provide report on the specialist designers' proposals within the main contract.		L					
4.9.40	Provide a report in consideration of any alternative plant, equipment, and component selections.		L					
4.9.41	Provide calculations and/or software files in support of specialist design proposals.		L					
	Amended and additional activity descriptions							
4.10.1	~~<insert text here>~~							

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PROFORMA 5: CONSTRUCTION AND COMMISSIONING (RIBA STAGE 5).
Some activities that start in the project's technical design stage may continue in parallel with this stage.
Reproduced from BSRIA BG 6/2018 A Design Framework for Building Services 5th edition

Ref	Design activity in connection with building services	Allocated to … L=Lead, S=Support, R=Review						Comments
		A	B	C	D	E	Z	
	General obligations, external liaison (statutory bodies, utilities)							
5.1.1	Notify the necessary statutory bodies (building control, fire officer, and environmental health) in respect of all tests and demonstrations required.		L					
5.1.2	Carry out airtightness test of completed building envelope.		L					
5.1.3	Seek full statutory approval of the works and arrange all necessary attendance, and documentation.		L					
5.1.4	~~Apply for G59 interfaces (for connection of onsite electricity generation to the grid).~~							
	Client liaison (briefing, handover, surveys)							
5.2.1	Oversee the instruction of the client's staff (FM team and end-users as appropriate) in the use, operation and maintenance of the installations.		L					
5.2.2	Prior to handover, instruct the client's staff (FM team and end-users as appropriate) in the use, operation and maintenance of the installations in advance of handover.		L					
5.2.3	Examine and comment on the contents of the operating and maintenance information in order to ensure compliance with the specified requirements.	L						
5.2.4	Modify and update operating details to reflect commissioning results.		L					
5.2.5	Modify project information as the works progress, so that all alterations arising during installation are recorded.		L					Models, drawings, schedules, etc.
5.2.6	Inspect draft record drawings at agreed intervals and comment on their content with respect to the size and positions of installed systems and plant.	L						
5.2.7	~~Establish central and visible 'home base' for aftercare team as defined by Soft Landings.~~		L					
5.2.8	Arrange for all appropriate maintenance contracts to be in place for start immediately after handover.		S				L	
5.2.9	Provide recommendations for the commencement and carrying out of operation and maintenance during and after the defects liability period.		L					
	Team liaison (builders' work, spatial coordination, energy targeting)							

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PROFORMA 5: CONSTRUCTION AND COMMISSIONING (RIBA STAGE 5).
Some activities that start in the project's technical design stage may continue in parallel with this stage.
Reproduced from BSRIA BG 6/2018 A Design Framework for Building Services 5th edition

Ref	Design activity in connection with building services	Allocated to … L=Lead, S=Support, R=Review						Comments
		A	B	C	D	E	Z	
5.3.1	Prepare accredited as-constructed energy consumption information for Building Regulations and (if relevant) the actual Energy Performance Certificate.		L					
5.3.2	Update building services information models in response to changes made during construction, installation and commissioning.		L					
	Selection of plant and specialist designers							
5.4.1	Review Contractor Design Portion, trade contractor or specialist design information against the technical design.	R	L		S			
5.4.2	Incorporate changes arising from Contractor Design Portion, trade contractor or specialist design information in the technical design, and revise models, drawings and information as appropriate.		L		S			
	Mechanical design							
	Electrical design							
	Public health design							
	Commissioning							
5.8.1	Comment on the adequacy of systems for commissioning as detailed on specialists' drawings and manufacturers' shop drawings prior to actual manufacture at works.	S	L					
5.8.2	Attend commissioning meetings as necessary.	S	L		S			
5.8.3	Arrange and chair commissioning meetings as necessary.		L					
5.8.4	Monitor the progress of commissioning and testing of all software programming, systems and plant, including assessment of whether installations meet the original (or amended) design intent.	R	L		S			
5.8.5	Conduct mock-up performance tests.	R	L		S			
5.8.6	Conduct pre-commissioning works (verification of installation works and static tests).	R	L		S			
5.8.7	Commission all systems to agreed method, logic and programme, and in accordance with the commissioning specification. Record the results.	R	L		S			
5.8.8	Attend witness testing and commissioning of off-site manufactured assemblies at manufacturers' premises.	S	L		S			Usually during manufacture

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PROFORMA 5: CONSTRUCTION AND COMMISSIONING (RIBA STAGE 5).
Some activities that start in the project's technical design stage may continue in parallel with this stage.
Reproduced from BSRIA BG 6/2018 A Design Framework for Building Services 5th edition

Ref	Design activity in connection with building services	Allocated to … L=Lead, S=Support, R=Review						Comments
		A	B	C	D	E	Z	
5.8.9	Demonstrate that the overall and complete systems perform correctly in the required manner and as intended by the specification.	R	L		S			
5.8.10	Record all plant settings from commissioning.		L		S			
5.8.11	Accept completed systems.	L			R			
	Deliverables – including drawings, specifications, reports							
5.9.1	Provide final installation details, including dimensions, of electrical switchgear to ensure that cable entry is acceptable in the selected location and that safe operating and maintenance clearances are provided.	R	L					
5.9.2	Provide final installation details, including dimensions, of automatic control panels to suit the detailed requirements of the agreed supplier of the controls equipment.	R	L					
5.9.3	~~Provide detailed BMS point schedules, wiring schematics, control panel labelling details and equipment schedules for the complete works.~~							
5.9.4	Provide detailed electrical wiring diagrams of all equipment supplied showing all interconnections between equipment to enable all necessary wiring to be undertaken.	R	L					
5.9.5	~~Provide installation model.~~							
5.9.6	Provide installation drawings.	R	L					
5.9.7	Provide builders' work details.	R	L					
5.9.8	Provide shop and fabrication drawings.	R	L					
5.9.9	Provide a final commissioning report detailing the results of the commissioning and commenting on the performance of systems signed by a competent person.	R	L					
5.9.10	Provide schedule of activities/works required for handover.	R	L					
5.9.11	Provide all necessary calculations, drawings, information and logs for the Health and Safety File.	R	L					
5.9.12	Provide a schedule of all spare parts required for the works including recommendations of any others not stated in the specification.	R	L					
5.9.13	Provide a schedule of all tools required for the works including recommendations of any others not stated in the specification.	R	L					
5.9.14	Provide operating and maintenance manuals.	R	L					Identify specialist author for production

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PROFORMA 5: CONSTRUCTION AND COMMISSIONING (RIBA STAGE 5).
Some activities that start in the project's technical design stage may continue in parallel with this stage.
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Ref	Design activity in connection with building services	Allocated to … L=Lead, S=Support, R=Review						Comments
		A	B	C	D	E	Z	
5.9.15	~~Provide as-built model or final project information model (as per BS EN ISO 19650-1 / BS EN ISO 19650-2) incorporating all changes made during installation.~~							
5.9.16	Provide record drawings incorporating all changes made during installation.	R	L					
5.9.17	Provide building manual(s) and/or building user guide(s) and/or building log book(s) in accordance with the requirements of the specification and the Building Regulations.	R	L					Including system completion certificates and instructions on controls, energy saving and water saving features.
5.9.18	Provide planned preventative maintenance schedules.	R	L					
5.9.19	Provide operation and maintenance information in accordance with the specified requirements.	R	L					
5.9.20	Provide comments on draft record information and operating and maintenance manuals.	R	L					
5.9.21	Provide technical guide for the facilities management team.	R	L					
5.9.22	Provide recorded water, gas and electricity meter readings on completion of the works.	R	L					
5.9.23	Provide pre-handover defects schedule.	R	L					Usually these defects are expected to be rectified before handover
5.9.24	Provide site visit reports.	R	L					
5.9.25	Provide comments on proposals submitted by the building services contractors and/or trade-contractors.	R	L					
5.9.26	Sign off design and equipment changes proposed.	R	L					
5.9.27	Provide comments on programmes.	R	L					
5.9.28	Provide as-installed information to the Environmental Assessment Method Assessor.	R	L					
5.9.29	~~Provide report on agreed outcomes following participation in any Soft Landings process.~~							
	Amended and additional activity descriptions							
5.10.1	~~<insert text here>~~							

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PROFORMA 6: HANDOVER AND CLOSE OUT (RIBA STAGE 6)

Reproduced from BSRIA BG 6/2018 A Design Framework for Building Services 5th edition

Ref	Design activity in connection with building services	Allocated to … L=Lead, S=Support, R=Review						Comments
		A	B	C	D	E	Z	
	General obligations, external liaison (statutory bodies, utilities)							
	Client liaison (briefing, handover, surveys)							
6.2.1	Update as-built/project information models in response to changes made during handover.		L					
6.2.2	~~Incorporate relevant information from project information model into asset information model (as per BS EN ISO 19650-1 / BS EN ISO 19650-2 and PAS 1192-3).~~							
6.2.3	On site attendance by aftercare team during first eight weeks of occupation.		S		S		L	
6.2.4	Hold meetings/workshops with end-users/occupiers during the first eight weeks of occupation.		S		S		L	
6.2.5	~~Hold regular meetings with user representatives during Year 1 of occupation.~~							Specify frequency, e.g. every 3-4 months in Year 1
6.2.6	Review building performance against energy targets during Year 1 of occupation.		L		S			Specify frequency, e.g. every 3 months
6.2.7	Hold end-of-year reviews of the general and environmental performance of the building.		L		S			
6.2.8	Visit site to train and/or transfer information about the use of the building services to the facilities management team and the building occupiers.		L		S			
	Team liaison (builders' work, spatial coordination, energy targeting)							
6.3.1	Review project health and safety performance.	S	S	S	S		L	
6.3.2	Organise lessons learned workshop for the project with design team, main contractor, significant specialist contractors and FM team.	S	S		S		L	In this context, specialist contractors may mean the key contractors responsible for major work packages such as building services, controls, steelwork, partitions, etc.
	Selection of plant and specialist designers							
	Mechanical design							
	Electrical design							

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PROFORMA 6: HANDOVER AND CLOSE OUT (RIBA STAGE 6)

Reproduced from BSRIA BG 6/2018 A Design Framework for Building Services 5th edition

Ref	Design activity in connection with building services	Allocated to … L=Lead, S=Support, R=Review						Comments
		A	B	C	D	E	Z	
	Public health design							
	Commissioning							
6.8.1	Carry out seasonal commissioning from practical completion including environmental testing and monitoring.		L		S			Define timetable
6.8.2	Attend seasonal commissioning activities carried out by others.		L		S			
	Deliverables – including drawings, specifications, reports							
6.9.1	Provide a reviewed and updated list of defects identified during post completion audit.		L		S			
6.9.2	~~Provide COBie tables for BIM Level 2 Information Exchange 6.~~							
6.9.3	~~Provide written reviews of energy use and system performance (as defined in the Soft Landings framework).~~							
6.9.4	~~Provide outturn cost analysis.~~							
6.9.5	Provide updated as-built/project information model incorporating defect rectification and any changes resulting from Year 1 aftercare.		L					
6.9.6	Provide updated record drawings incorporating defect rectification and any changes resulting from Year 1 aftercare.		L					
6.9.7	Provide lessons learned report.	S	L		S			
6.9.8	Provide report on any defects reported during the liability period.	R	L		S			
6.9.9	Provide comments on record information including operating and maintenance manuals.	L	S		S			
6.9.10	~~Provide report on agreed outcomes following participation in any Soft Landings process.~~							
	Amended and additional activity descriptions							
6.10.1	~~<insert text here>~~							

A33sch – Schedule of Engineering Services Samples

The following Samples shall be submitted for Approval in accordance with Clause A33.170.004 (or A64. 700.006 or A64D A33.170.004) once the Technical Submission for the item has obtained 'A' or 'B' status.

Work Section	Sample
R11	Foul Drainage Above Ground
	Shower floor gully
S10	Water Booster Set Triplex houses in-line mains booster set
S61	Dry Riser
	Dry riser outlet box
S63	Sprinklers
	Each type of sprinkler head (incl' each type of finish)
T14	Ground source heat pump
T20	Primary Heat Distribution
	Each type of radiator
	Perimeter heating channel / grille
U10	Supply / Extract
	Each type of louvre / grille
U14	Smoke Extract / Control
	Firefighting lobby vent manual controls
	Lobby vent louvre / damper
V21	General Lighting
	Each type of light switch or lighting control system scene selector switch. Sample EM Test key switch engraving.
	Ceiling and wall mounted PIR
	External photo-cell
V22	General Power
	Each type of wiring accessory proposed for use in front-of-house areas. Sample designation engraving and circuit identification.
W15	Facilities for the Disabled
W20	CCTV
	Each type of camera
W40	Access Control
	Card reader
	External Door Entry Unit
	Request to Exit Button
	Manual Breakglass Unit
W41	Security Detection and Alarm
	Each type of door contact
W50	Fire Detection and Alarm
	Manual call point
	Each type of automatic detector (incl' each type of finish)
	Each type of visual alarm indicator
	Door hold open magnet complete with mounting bracket and manual release button
W52	Lightning Protection
	Each type of exposed conductor tape
	Each type of exposed conductor tape fixing
W60	Controls / Monitoring
	Wall mounted temperature sensor
Y73	Luminaires

A33sch – Schedule of Engineering Services Samples

Refer to Schedule Y11sch2 for general system valves.

Pressure reducing valves
PRV's to be sized by the valve manufacture to ensure pressure stability over the required operating range.

Water Hammer Arrestors
Application

Maintenance free, mechanical water hammer arrestor to eliminate water hammer caused by fast closing valves, such as quick action taps and solenoid valves within pipework systems.

Components

Vessel volume: 0.16 litres
Vessel volume: 2.0 litre
Maximum pressure rating: 5 bar
Pres-set pressure: 1.5 bar (set to site static pressure)
Operating temperature: -10 deg C to +100 deg C
Body material: Epoxy coated carbon steel
Shell material: Stainless steel 304

Manufacturers Ref - Reliance Water controls model range XVES 600 or equal approved, WRAS or equivalent approved.
Each unit shall be fitted with Lockshield Service valve with internal full bore diameter not less than shock arrestor selected.

Combination Surge Arrestor and Air Release Valve
Application

Combined automatic surge protection, air release and vacuum protection to dampen effect of water hammer at pump start-up and provide vacuum protection when the pump stops and the riser drains.

Components

Pressure rating: 6 bar (Max Allowable 13.5bar)
Operating temperature: 5 to 60 deg C
Construction material: Brass and Stainless steel with VITON and PTFE seals

Manufacturers Ref

Aquatech Pressmain or equal approved.
Product code:

"AQUAVENT" Refill Valve For Pressure Boosted Water Supply
For max. 200mm riser diameter. Supplied with pipeline strainer and isolation valve

WRAS or equivalent approved

Ensure valve is commissioned in accordance with manufacturers requirements and regular maintenance is carried out.
Each unit shall be fitted with pipeline strainer and locked ¼ turn lever service valve with internal full bore diameter not less than surge arrestor selected.
Valve outlet to be piped to floor gully/tundish with air gap discharge.

Priority Demand Valve (For Domestic Fire Sprinkler Systems)
Application

Fire Priority Demand Valve (FPV) for use as part of a combined domestic sprinkler systems designed to BS9251:2021, that utilise the domestic water pressure booster set and break tank for both domestic water supply and fire suppression. If the sprinkler system is activated a control signal from the fire sprinkler flow switch is received by the FPV system, the controller then signals for the motorised valve to close. This isolates the flow of water to the domestic cold water riser enabling the booster set to pump all available water to the sprinklers riser. The FPV system holds the valve closed until manually reset (once the fire brigade has handed the building back to owner).

The valve will also stop the domestic flow when the break tank level gets too low. This allows the minimum tank volume, as recommended by BS9251:2021, to be retained for sprinkler operation.

Components

Pressure rating: 16 bar
Operating temperature: 3 to 40 deg C

Construction material: Brass and Stainless steel with VITON and PTFE seals
Wafer pattern butterfly type, suitable for fitting between BS4504
PN16 flanges and is available in all sizes 1" to 6".
Epoxy coated cast iron body with AISI 316 stainless steel disc, AISI 304 stainless steel stem, EPDM seat.
Available sizes DN25 to DN150

Control Features

- 6 line LCD multi coloured display to display status and alarm messages
- Break tank low water level interface with auto shut down of the domestic cold water supply
- Battery backup operation on power failure with alarm output
- Manual operation and reset if required
- Automated anti-seize function for self-protection
- 4 volt-free BMS/controls alarm status outputs
- Supplied fully pre-wired.

Manufacturers Ref
Aquatech Pressmain or equal approved.
Product code:
Fire Priority Demand Valve (FPV)
WRAS or equivalent approved

Ensure valve is commissioned in accordance with manufacturers requirements and regular maintenance is carried out.

Hose Union Taps
Bib tap with integral double check valve assembly and hose union outlet.
Crutch head.
Lockshield pattern with loose key.
15mm diameter or as stated in drawings
Chrome plated or bronze finish.

Thermostatic mixing valves
Refer to S11sch3

Cold water storage cistern monitoring
Edit applications, unit options and manufactures ref as necessary

Type:	Fully Automated Tank water volume/temperature monitoring unit to provide the following for single and partitioned tanks: Volume Temperature - Monitoring and high/low level alarms Water level – Monitoring and high/low level alarms Volt Free contacts to BMS/controls
Application(s):	Landlords Wholesome water storage,
Unit options:	Sensor – Single or Twin Repeater unit S-Module Battery Module Tanktronic Servo Ceramic Valve (SCV) Tanktronic Control Valve
Manufacturers Ref:	Keraflo Tanktronic or equal approved TT/43 monitoring Unit c/w 2 off 3m Sensor assemblies WRAS or equivalent approved.

Air admitance valves (AAV)

Performance parameters:

- Compliance with BS EN 1380:2002
- Condensation diverted from sealing membrane
- Temperature range -20ºC to +60ºC
- Opening pressure -70 Pa
- Max. pressure rating tightness 10,000 Pa at 0 Pa or higher
- Airflow capacity 7.5 l/s
- Accessible for maintenance and installed 200mm above highest drainage inlet.

Manufacturer: Studor or equivalent Building Control approved.

Ref	Service	Location	Type	Flow rate (l/s)	System max operating pressure (kPa)	Accessories/Notes/ mounting orientation
WC-A3-01	Boosted Cold Water	Apartment Block A3 plantroom - Serving blocks A1, A2, A3, A4	A	11.3	16	'Competition control box' or equivalent. WRAS or equivalent approved.
WC-A3-02	Boosted Cold Water	Apartment Block A3 plantroom - Serving blocks A1, A2, A3, A4	A	11.3	16	'Competition control box' or equivalent. WRAS or equivalent approved.
TBC	Boosted Cold Water	Apartment Blocks B, C, D, E, F (2No conditioners per plantroom, one in each BCW branch)	A	TBC	16	'Competition control box' or equivalent. WRAS or equivalent approved.
WC-HT	Water supply to DHW cylinder	MEP cupboard in each house type	B	1B – 0.25 l/s 2B&3B – 0.32 l/s 4B- 0.45 l/s	16	WRAS or equivalent approved. Selection of WC based on flow rate, and with minimal pressure losses in pipe.

Notes:

1. Unit minimum life expectancy – 10 years
2. Degree of protection to BS EN 60529 IP 65
3. Type

A Electromagnetic

An electrical coil type for generating the magnetic field, a designed flow path that enables the water to cross the magnetic field line at an angle of 90 degrees, with PTFE plated body, with control unit panel, fully programmable complete with fault report facility, display window and incorporation contacts for BMS/controls interface. The control box shall have a polarity reversal mechanism to eliminate routine maintenance of the unit, and should connect to a 240v/ 1ph /50Hz fused spur.
Manufacturer and reference: Hydrotec (UK) Ltd "Hy-Mag" or similar approved.

B Mechanical (non powered)

Type with cavitation chambers to create turbulence and pressure changes as the water passes through. The unit shall also contain a large surface area of zinc to promote cathodic protection for pipe work downstream and assist in breaking down existing corrosion leaving a neutral surface which remains protected.
Manufacturer and reference: The Rodin Group Ltd "Scalebuster" or similar approved.

Ref	Location	System	No of Pumps	Electrical details (at design duty)			Duty					Notes
				Ph	kW	A	Flow Rate (l/s)		Full flow Head (Bar g)	Limiting closed valve Head (Bar g)	Variable speed drive (yes/no)	
CWBS-A3-01	Block A3 Lower Ground Water Plantroom	Potable Cold Water and Residential Sprinklers	5	3	4.0 per pump	8.1 Per pump	2.83 l/s per pump	11.3 l/s total	7.1	8.9	Yes	Variable speed unit D/A/A/A/S with multistage pumps. Flow through vessel min 12 L. Type “Aquamatic” or equivalent for residential sprinklers according to BS EN 9251:2021.
CAT5-A3-01	Block A3 Lower Ground Water Plantroom	CAT5 water supply	2	1	0.75	5.5	0.5	0.5	Min 3 bar	4.6	Yes	Wall mounted unit with minimum 24L storage capacity @3bar, for 1No tap wash down and Living Wall System, Duty/Standby, var speed. Living Wall requirements TBC with appointed CDP, which shall be min requirements for CAT5 selection. WRAS or equivalent certified
CAT5-A1-01	Block A1 Bin store	CAT5 water supply	1	1	0.37	2.3	0.25	-	2.2	4.2	No	Wall mounted unit with minimum 18L storage capacity for 1No tap wash down. WRAS or equivalent certified
CAT5-A2-01	Block A2 Bin store	CAT5 water supply	2	1	0.75	5.5	0.5	0.5	Min 3 bar	4.6	Yes	Wall mounted unit with minimum 24L storage capacity @3bar, for 1No tap wash down and Living Wall System, Duty/Standby, var speed. Living Wall requirements TBC with appointed CDP, which shall be min requirements for CAT5 selection. WRAS or equivalent certified
CAT5-A4-01	Block A4 Bin store	CAT5 water supply	1	1	0.37	2.3	0.25	-	2.2	4.2	No	Wall mounted unit with minimum 18L storage capacity for 1No tap wash down. WRAS or equivalent certified
TBC	Block B, C, D, E, F plantrooms	Potable Cold Water	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	To be designed in next stage. One booster set per plantroom block, minimum 2No pumps in duty/assist.
TBC	Block B, C, D, E, F plantrooms	CAT5 water supply	1	1	0.37	2.3	0.25	-	2.2	4.2	No	Wall mounted unit with minimum 18L storage capacity for 1No tap wash down. WRAS or equivalent certified
CWBS-HT-01	Incoming main house types	Potable Cold Water	1	1	340 W	1.5	0.2 l/s (12 l/min)	-	6	3.2	Yes	Mains in line booster for triplex housetypes B3(P), C3(P), H1(P), F1(P), H2(P). Including anti vibration mat. Space allowance based in Stuart Turner pumps sizes

Notes:

1. Refer to clause S10 300.061 for standard details
   Manufacturer to be BS EN ISO 9001 registered
2. The unit is to comprise a fully automatic, self-contained packaged pumping set comprising of pumps, control panel, hydraulic accumulator (to increase pump rest time and reduce hydraulic shock at closed valve), pressure switches, system pressure gauge and interconnecting copper/stainless steel pipework, complete with pump motor and pressure switch wiring, all mounted on a common pre-fabricated steel base plate with anti-corrosion finish. The pump units shall be arranged to operate as above and be complete with a suitable break tank low level protection device either within tank or provided as part of packaged pump set on pump set suction manifold. Pumpset manufacture shall ensure that the packaged pumpset operates with stable flow and pressure across the full variable design flow rate from zero to full flow.
3. The pumps will be vertical multi-stage type having cast iron bodies, stainless steel shaft and impellers fitted with ceramic faced tungsten carbide mechanical seals with the necessary WRAS approval or equivalent. Standard motors would be continuously rated, totally enclosed fan cooled type with class " F " insulation and IP55 protection.
4. Pump Pressure control
   Constant pressure control by pump seed control, with pressure sensor located on pump manifold.
   Use variable speed pump drives with system fill mode to provide pressure control and to avoid hydraulic shock on start up
   Where required all pumps within the package shall run and cascade via the pressure control system. Should the 1st pump fail the support pumps shall still operate. Provide additional control module to provide surge protection on start-up or when power is restored by allowing only one pump to be enabled and pulsed for a pre-set time until a pre-set pressure is reached.
   VSD fitted to pump / motor
5. The suitably pressure rated hydraulic accumulator will be sized to limit the number of starts to approximately 10 per hour. The external steel shell will be fitted with a replaceable butyl membrane. The accumulator shall be integrated 'flowjet' type flow-through unit, with shut-off and discharge valve to avoid stagnant water in drinking applications
6. The control panel shall comply with the latest revision of the IET Wiring Regulations (BS 7671) have an overall IP55 protection rating 9.5

Single enclosure for
-Incoming mains, door-interlocked isolator, common controls, Starters for each pump, low pressure, high and low level, pump sequencing and automatic changeover controls. For each pump, Hand/Off/Auto selector, contactor(s) and protective devices.
Where the pumps have variable speed drives, the inverters shall be either be mounted on the pumps or on the support framework outside the control panel enclosure.
Provide control module to provide surge protection on start-up or when power is restored by allowing only one pump to be enabled and pulsed for a pre-set time until a pre-set pressure is reached.

Provide:

Lamp indicators for	Individual volt-free contacts for
Controls Voltage ON	Common fault
Low Pressure (Pump Delivery)	Low Pressure

Low Level (Break Tank)	Low Level (if break tank included)
Pump Run	Pump Fault (each pump)
Pump Fault	

Note a All protection equipment shall be fully discriminating with upstream and downstream devices to ensure maximum motor protection.

Note b In some instances miniature-circuit breakers may be used in place of fuses.

7. Booster sets assembled in 316L stainless steel pipework.

8. Each pump shall be provided with separate isolating and non-return valves, with a further isolating valve on the final outlet with 100mm dial pressure gauge flexible connections to pipework and anti-vibration mountings.

9. All valves and components to be WRAS approved and comply fully with the Water Regulations.

10. Where pumps do not have variable speed drives, the unit is to incorporate an adjustable modulating pilot operated pressure-regulating valve assembly on the main delivery connection to provide equal and stable pressure in the Hot and Cold services.

11. Each complete booster set shall be fixed to common baseplate and mounted on raised concrete plinth with anti-vibration mountings.

12. Accessories - Provide combined anti-vacuum, automatic air vent and surge protection valve supplied loose for fitting at top of risers.

13. Allow for commissioning on site by manufacturer/supplier.

S10sch4 – Schedule of Water Meters

Proposed metering strategy must be validated with Landlord, Facilities Management and Southern Water.

Apartment Block A metering strategy is below. Other typical apartment blocks meters schedule to be specified by contractor.

Meter Ref	**WM-A3-01**	**WM-A3-02**	**WM-A3-03**	**WM-A3-04**
Location	Block A External Chamber – Leak Detection Meter on Incoming water mains 63Ø OD MDPE connections (inclusion TBC by management strategy)	Block A External Chamber- Utility Company Water meter on 63Ø OD MDPE Incoming water mains	Block A3 Leak Detection Meter - Incoming Domestic Mains Water Supply to Water storage tank in Water Storage Plant room (inclusion TBC by management strategy)	Block A3 Incoming Domestic Mains Water Supply to Water storage tank Water Storage Plant room
Pipe diameter (mm)	Utility company meter	Utility company meter	54	54
Water temperature (^{0}C)			Ambient	Ambient
Number of meters			1	1
Maximum working pressure (KPa)			1600	1600
Connections			Flanged or screwed	Flanged or screwed
Electrical Details			15 year battery life IP 68	15 year battery life IP 68
Accuracy at maximum flow			+/- 5%	+/- 5%
Meter accuracy class to BS EN ISO 4064-1			2	2
BMS interface			No	No
Landlords Billing			No	No
Major Leak detection facility for BREEAM Compliance			TBC	No

S10sch4 – Schedule of Water Meters

Meter Ref	WM-A3-05	WM-A3-06	WM-A1-01	WM-A1-02
Location	Block A3 Water Plantroom Room – Combined Boosted domestic cold water & Sprinkler supply to block A3 sub meter 76Ø OD Copper connection (inclusion TBC by management strategy) Non Revenue	Block A1/A2/A4 Water Plantroom Room – Boosted domestic cold water to blocks A1, A2, A4 sub meter 76Ø OD Copper connection (inclusion TBC by management strategy) Non Revenue	Revenue Meter - Domestic BCWS to Block A1 in buried external Valve chamber 50Ø OD MDPE connections	Revenue Meter - Domestic BCWS to Block A1 Ground floor apartment in buried external Valve chamber 32Ø OD MDPE connections
Pipe diameter (mm)	76	76	50 MDPE	32 MDPE
Water temperature (^{0}C)	Ambient	Ambient	Ambient	Ambient
Number of meters	1	1	1	1
Maximum working pressure (KPa)	1600	1600	1600	1600
Electrical Details	15 year battery life IP 68	15 year battery life IP 68	15 year battery life IP 68	15 year battery life IP 68
Accuracy at maximum flow	+/- 5%	+/- 5%	+/- 5%	+/- 5%
Meter accuracy class to BS EN ISO 4064-1	2	2	2	2
BMS interface	No	No	No	No
Landlords Billing	Yes	Yes	Yes	Yes
Major Leak detection facility for BREEAM Compliance	No	No	No	No

S10sch4 – Schedule of Water Meters

Meter Ref	WM-A2-01	WM-A4-01
Location	Revenue Meter - Domestic BCWS to Block A2 in buried external Valve chamber 40Ø OD MDPE connections	Revenue Meter - Domestic BCWS to Block A4 in buried external Valve chamber 50Ø OD MDPE connections
Pipe diameter (mm)	40 MDPE	50 MDPE
Water temperature (^{0}C)	Ambient	Ambient
Number of meters	1	1
Pressure drop at maximum flow (KPa)	30	30
Maximum working pressure (KPa)	1600	1600
Electrical Details	15 year battery life IP 68	15 year battery life IP 68
Accuracy at maximum flow	+/- 2%	+/- 2%
Accuracy at maximum flow	+/- 5%	+/- 5%
Meter accuracy class to BS EN ISO 4064-1	2	2
BMS interface	No	No
Landlords Billing	Yes	Yes
Major Leak detection facility for BREEAM Compliance	No	No

Meter Ref	FOR APARTMENTS	FOR APARTMENTS	FOR HOUSE TYPES	FOR HOUSE TYPES
Location	Revenue Meter - Domestic BCWS to 1&2 Bed type Apartments in water riser in the core at each level of each Block	Revenue Meter - Domestic BCWS to 3&4 Bed type Apartments in water riser in the core at each level of each Block	Non Revenue Meter Domestic BCWS to 2 Bed type Houses in buried external Valve chamber	Non Revenue Meter Domestic BCWS to 3&4 Bed type Houses in buried external Valve chamber
Pipe diameter (mm)	22	28	25 MDPE	32 MDPE
Water temperature (^{0}C)	Ambient	Ambient	Ambient	Ambient
Number of meters	To all 1B&2B apartments	To all 3B&4B apartments	To all 2 Bed house types	To all 3&4 Bed house types
Maximum working pressure (KPa)	600	600	600	600
Electrical Details	15 year battery life IP 68	15 year battery life IP 68	15 year battery life IP 68	15 year battery life IP 68
Accuracy at maximum flow	+/- 5%	+/- 5%	+/- 5%	+/- 5%

Meter accuracy class to BS EN ISO 4064-1	2	2	2	2
BMS interface	No	No	No	No
Landlords Billing	No	No	No	No
Major Leak detection facility for BREEAM Compliance	No	No	No	No

Notes

1. Meters to be WRc approved
2. The water meter and BMS interface system shall be capable of identifying major leaks both within the building and between the building and the site boundary
3. The leak detection system shall be:
   - Audible when activated;
   - Activated when a continuous flow of water passes through the water meter at a flow Rate above a pre-set minimum for a pre-set period of time;
   - Able to identify different leakage rates, e.g. continuous, high and/or low level leaks, over set time periods
   - Programmable to suit the owner/occupiers' requirements
   - Designed to avoid false alarms caused by normal operation of large water consuming plant

   The system need not cut off the water supply when the alarm is triggered.

S10sch5 – Schedule of Water Disinfection Dosing Plant

Water Disinfection system below is for Block A3 Combined water tank with residential sprinklers – dosing recirculation system with Hypochlorous Acid.

Water Disinfection for other blocks – dosing disinfection system, in-line or recirculation. If in line, dosing is prior to water tank with Hypochlorous Acid, part of contractor's D&B selection to be further designed.

Reference	WD01
System	Domestic Wholesome water
Location	Block A3 Lower Ground Plantroom
Type	Proportional Hypochlorus Acid dosing unit for approx. 10 m3 tank
Description / dosing method	Permanent installation, packaged, automatic dosing plant with control panel. Pumps and electronics to be located in separate chambers. Unit shall re-circulate tank water and continuously measure levels of chlorine in tank water, dosing chemical as required. Unit to be supplied complete with re-circulation pump within packaged unit. Chemical injection tubes can be single or double walled tube. Monitoring cell cleaned as part of maintenance program. Unit shall be complete with injection block and chemical bunds with facility for storage of relevant COSHH data sheets. Chemical injection when ppm are under below pre-set concentration.
Method of water supply	Water tank re-circulation
Pressure	7bar
Drinking Water Inspectorate (DWI) chlorine limit	0.5mg/l
BMS interface	Volt free contacts for unit common fault and chemical low and ultra low level as well as High chlorine (stops dosing) - Low chlorine - Dosing time exceeded (stops dosing) - Loss of flow through measuring cell (stops dosing) - Loss of re-circulation flow - Loss of dilution flow - Probe failure (stops dosing). Ultra low chemical alarms will also activate system shut down
Power supply	230 V / 1ph / 50 Hz
Control panel IP rating	IP 55
Visual alarms	Set point (ppm) Actual chemical level (ppm) High level alarm (ppm) Oxidation Reduction Potential (ORP)
Audible alarms required at control panel	High level alarm and low level alarm (ppm)
Unit assembly	Packaged free standing unit
Pipework	Dosing recirculation lines – uPVC to BS 3505
Chemical containment	Within lockable bunded enclosure Chemical injection tubes double walled
Initial supply of chemicals	2No 25L chemical drums
Certification	The Water Supply (Water Quality) Regulations 2010 SI No 994 (W.99)
Documentation	Plant manufacturers shall provide unit data sheets, maintenance and COSHH data sheets
PPE	Hypochlorous acid is classified as non hazardous and no PPE is strictly required
Testing and commissioning requirements	Two stage commissioning process – first visit to assess works, second visit when water system is under operation and as close to PC as possible for final commissioning, or as per manufacturer recommendations

Clarification	Widely used Chorine Dioxide disinfection is not advised with PE-X pipework. Potential changes in the pipe material and water design can influence water disinfection system selection.

Notes:

1. Plant selection based on ClearWater Ultralox unit or equal approved
2. Refer to clause S10.300.067 for standards
3. Plant shall comply with CIBSE TM13:2000 and HSC ACOP L8 and HSG 274 Part 2
4. All dosing chemicals to be DWI Regulation 25 approved
5. All components in contact with water flow shall be WRAS approved or equivalent certification under Water Regulations UK
6. Equipment to be provided with warranty of 5 years from PC.

Cylinders

Ref	Service	Capacity (litres)	Dimensions (mm)	BS / Type	Temperature	Notes
DHWC-150	Domestic Hot Water	150	545(d)x1081(h)	Indirect cylinder, floor mounted, designed for heat pump applications	Min 60C storage	Refer to Heat Pump schedule T14Sch2 for indirect cylinder size to apartment or house type. WRAS approved unit or equivalent certification. 3kW immersion heater and expansion vessel included.
DHWC-200	Domestic Hot Water	200	545(d)x1399(h)	Indirect cylinder, floor mounted, designed for heat pump applications	Min 60C storage	Refer to Heat Pump schedule T14Sch2 for indirect cylinder size to apartment or house type. WRAS approved unit or equivalent certification. 3kW immersion heater and expansion vessel included.

Note: Literature should be provided for residents to understand how to manage hot water supply by pre-programming the GSHP/DHW system. Typically DHW is set to generate twice a day, in morning and end of afternoon. Boost option may be necessary prior to larger water demands.

Expansion Vessels

Water Heater Ref (from above)	DWHC-150	DHWC-200
Location	MEP cupboard	MEP cupboard
Standard	BS 6144	BS 6144
Water content (l)	12	18
Safety valve pressure (KPa)	6 bar	6 bar
Mounting details /Notes	Wall	Wall

Notes

1. Primary heating surface shall be sized at 20% greater than the design duty, in order to ensure that temperatures are maintained throughout the life of the plant
2. “Tank in Tank” type - inner tank to be stainless steel and outer primary tank to be steel
3. Storage cylinders shall comply with relevant British Standards and Water Supply (water fittings) Regulations 1999
4. Unvented units to be complete with “unvented kits” and pressure regulating valve to comply with Building Regulations safety requirements within Approved Document G3. Units shall be comply with BS EN 12897
5. Cylinders to have man access
6. Units to be insulated at manufacturers works
7. Cylinders to be complete with the following accessories:
   - Combined immersion heater and thermostat (Top entry, Side entry)
   - Insulation jacket to BS 5615.
   - Factory applied insulation
   - Drain cock
   - Additional primary heater – minimum surface area as indicated

Aluminium protector rod
Arrangement – vertical
Type of Heater – helical coil
Shell material – copper or carbon steel (galvanised, galvanised with sacrificial anode, sealed zinc sprayed, copper lining or copper lining with aluminium anode)
No circulation.

Thermostatic mixing valves (TMV's)

Specification of TMVs in accordance with below and Architectural sanitaryware list.
In compliance with Building Regulations, bathtubs shall include mixers with incorporated TMV.
Shower heads are advised to include TMV mixers although not statutory required.

Thermostatic mixing valves should be sited as close as possible to the point of use.

1. All non-metallic parts in contact with water shall meet WRAS requirements (or equivalent) or comply with relevant parts of BS 6920
2. Valves to be independently tested and approved to BuildCert scheme TMV2.
3. Standard/type
    a. BS EN 1111 for high operating pressure (1-5bar)
        i. Type 1 - single control.
        ii. Type 2 - dual control.
        iii. Type 3 - single sequential control.
    b. BS EN 1287 for low operating pressure (0.2-1bar)
        i. Type 1 - single control.
        ii. Type 2 - dual control.
        iii. Type 3 - single sequential control.

Type: TMV/A

Application	Mixing valve feeding a maximum of one appliance
Min/max. flow rate(l/min)	3/9
Head loss at max. flow	Maximum 0.5 bar
General	Exposed model, surface mounted. With tamper proof temperature locking facility, inlet strainers and integral non-return valves.
Finish	As per Architecture specification

S61sch – Schedule of Dry Riser Systems

Dry riser supplied by inlet in façade, distributing from Ground floor core lobby up to highest floor of apartments or accessible flat roof (Block A1).

Inlet breeching	2 or 4 way BS 5041-3			
	Non Return Valve	Yes/No		
	Integral Drain Valve	Yes/No		
Inlet Box	BS 5041-5	Yes/No		
	Door Finish	Stainless Steel		
		Painted Steel		
		Colour		
Landing Valves Location	BS 5041-2			
	Within a ventilated lobby approach stairway			
	In a stairway enclosure			
	As indicated on the Architects drawings			
	750mm Above finished floor level			
Outlet box	BS 5041-4	Yes/No		
	Door Finish	Stainless Steel		
		Painted Steel		
		Colour		
	Purpose made	Yes/No		
	Door Finish	Stainless Steel		
		Painted Steel		
		Colour		
Intermediate Riser Isolation Valves	Valves to be butterfly type and comply with the face to face dimensions of BS EN 593 suitable for fire systems to BS 9990			
	Approvals	LPC, FM or UL		
	Lever lockable type	Yes / No		
	Wheel head geared type	Yes / No	Monitored	Yes / No
			Lockable	Yes / No

T14sch2– Schedule of Ground Source Heat Pumps

GROUND SOURCE HEAT PUMPS (GSHP)

UNIT REFERENCE	GSHP-01	GSHP-02
UNIT TYPE		
LOCATION		
HOUSE TYPE	K1(A), K1(P), K2(A), K2(P)	A1(A), A1(P), A2(A), A2(P), B2(A), B2(P), B3(P), C1(A), C1(P), C3(P), D1(A), D1(P), F1(A), F1(P), H1(P), H2(P), J1(A), J1(P)
APARMENT TYPE	For 1B2P flats	For non 1B2P flats
QUANTITY		
DUTY		
Source flow rate l/s	By specialist	By specialist
Source Glycol %	22	22
Source water temp for peak heating output ºC	By specialist	By specialist
Source water temp rise ºC	By specialist	By specialist
Source water pressure loss kPa	By specialist	By specialist
Sink water flow rate l/s	By specialist	By specialist
Sink water flow and return temperatures ºC	By specialist	By specialist
Sink water pressure loss kPa	By specialist	By specialist
Peak Heating output kW	6 kW	6 kW
Peak Cooling output kW	-	-
NUMBER OF COMPRESSORS	1	2
COMPRESSOR TYPE	Reciprocal	Reciprocal
MOTOR TYPE / EFFICIENCY	Fixed Speed	Fixed Speed
NUMBER OF CONTROL STAGES	By specialist	By specialist
REFRIGERANT	R134a	R134a
Limiting noise level in plant room (Sound pressure level dBA re 2x10 -5 Pa @ xx m from heat pump	Please refer to the Acousitc consultant's requiremenet	
Electrical details (1ph or 3ph)	1ph	1ph
Electrical power input (kW)	1.6	1.6
Limiting current draw at start up (A)	34	34
Minimum COP (heating) at peak output	3.84	3.84
Minimum COP (heating) at minimum output		
Seasonal coefficient of performance (SCOP)	2.97	2.97
Minimum EER (cooling) at peak output	N/A	N/A
Minimum EER (cooling) at minimum output	N/A	N/A
DHW Cylinder (L)	150 (w/ immersion heater and internal DN32mm coil)	200 (w/ immersion heater and internal DN32mm coil)
Minimum Seasonal space heating energy efficiency to EU Regulation 2016/2281		
Minimum Seasonal space cooling energy efficiency to EU Regulation 2016/2281		

Note:

1. All GSHP shall fulfil the Part L minimum requirement.
2. All underground and borehole installation, requirement and specification, please refer to Ground Loop Design Specification 60663039-ACM-XX-XX-SP-ME-00001

Location	Room / Area Served	Output (W)	Room air temp (°C)	Room noise level (NR)	Type	Height (mm)	Length (mm)	Depth (mm)	Electrical details (W)	Accessories/Special Requirements/Notes
		Per Unit				Per Unit			Per Unit	
Houses / Apartments	WC / Bathroom	246	20	Refer Note 5	Towel Rail	760	500	100	246	-

***Wherever Towel Rail is applicable, above mentioned technical data to follow.**

*** Refer to next page for LTHW Radiators within the Houses**

House Reference	Room / Area Served	Heat Load (W)	Room air temp (°C)	Room noise level (NR)	Type	Height (mm)	Length (mm)	Depth (mm)	Selected Unit Capacity (W)	Accessories/Special Requirements/Notes
		Per Room				Per Unit			Per Unit	
House A1(P)										
A1(P)-RAD-001	Master Bedroom	590	19	Refer Note 5	LTHW Radiator	600	1100	112	1550	-
A1(P)-RAD-002	Bedroom 2	425	19			600	800	112	1130	-
House A1(A)										
A1(A)-RAD-001	Master Bedroom	595	19	Refer Note 5	LTHW Radiator	600	1100	112	1550	-
A1(A)-RAD-002	Bedroom 2	425	19			600	800	112	1130	-
A1(A)-RAD-003	Bathroom	195	19			450	500	112	555	AR Type Houses to have Wet Radiator. FH Type Houses to have Wet Towel Rail.
House A2(P)										
A2(P)-RAD-001	Master Bedroom	525	19	Refer Note 5	LTHW Radiator	600	1000	112	1410	-
A2(P)-RAD-002	Bedroom 2	435	19			600	900	112	1270	-
A2(P)-RAD-003	Hall	195	19			450	500	112	555	-
House A2(A)										
A2(A)-RAD-001	Master Bedroom	530	19	Refer Note 5	LTHW Radiator	600	1000	112	1410	-
A2(A)-RAD-002	Bedroom 2	435	19			600	900	112	1270	-
A2(A)-RAD-003	Bathroom	170	19			450	500	112	555	AR Type Houses to have Wet Radiator. FH Type Houses to have Wet Towel Rail.
A2(A)-RAD-004	Hall	200	19			450	500	112	555	-
House D1(A)										
D1(A)-RAD-001	Master Bedroom	640	19	Refer Note 5	LTHW Radiator	600	1200	112	1695	-
D1(A)-RAD-002	Bedroom 2	445	19			600	900	112	1270	-
D1(A)-RAD-003	Bedroom 3	410	19			600	800	112	1130	-
D1(A)-RAD-004	Bathroom	160	19			450	500	112	555	AR Type Houses to have Wet Radiator. FH Type Houses to have Wet Towel Rail.
House D1(P)										
D1(P)-RAD-001	Master Bedroom	460	19	Refer Note 5	LTHW Radiator	600	900	112	1270	-
D1(P)-RAD-002	Bedroom 2	445	19			600	900	112	1270	-

House Reference	Room / Area Served	Heat Load (W)	Room air temp (°C)	Room noise level (NR)	Type	Height (mm)	Length (mm)	Depth (mm)	Selected Unit Capacity (W)	Accessories/Special Requirements/Notes
		Per Room				Per Unit			Per Unit	
D1(P)-RAD-003	Bedroom 3	410	19			600	800	112	1130	-
House B2(P)										
B2(P)-RAD-001	Master Bedroom	530	19	Refer Note 5	LTHW Radiator	600	1000	112	1410	-
B2(P)-RAD-002	Bedroom 2	435	19			600	900	112	1270	-
B2(P)-RAD-003	Bedroom 3	365	19			600	700	112	990	-
B2(P)-RAD-004	Office	135	19			450	500	112	555	-
House B2(A)										
B2(A)-RAD-001	Master Bedroom	500	19	Refer Note 5	LTHW Radiator	600	1000	112	1410	-
B2(A)-RAD-002	Bedroom 2	475	19			600	900	112	1270	-
B2(A)-RAD-003	Bedroom 3	430	19			600	900	112	1270	-
B2(A)-RAD-004	Office	150	19			450	500	112	555	-
B2(A)-RAD-005	Hall	210	19			450	500	112	555	-
B2(A)-RAD-006	Bathroom	195	19			450	500	112	555	AR Type Houses to have Wet Radiator. FH Type Houses to have Wet Towel Rail.
House B3(P)										
B3(P)-RAD-001	Master Bedroom	730	19	Refer Note 5	LTHW Radiator	600	1400	112	1975	-
B3(P)-RAD-002	Bedroom 2	460	19			600	900	112	1270	-
B3(P)-RAD-003	Bedroom 3	415	19			600	800	112	1130	-
B3(P)-RAD-004	Office	110	19			450	500	112	555	-
B3(P)-RAD-005	Hall	350	19			450	900	112	995	-
House C1(P)										
C1(P)-RAD-001	Master Bedroom	610	19	Refer Note 5	LTHW Radiator	600	1100	112	1695	-
C1(P)-RAD-002	Bedroom 2	465	19			600	900	112	1270	-
C1(P)-RAD-003	Bedroom 3	400	19			600	800	112	1130	-
House C1(A)										
C1(A)-RAD-001	Master Bedroom	780	19	Refer Note 5	LTHW Radiator	600	1600	112	2255	-
C1(A)-RAD-002	Bedroom 2	470	19			600	900	112	1270	-
C1(A)-RAD-003	Bedroom 3	400	19			600	800	112	1130	-

House Reference	Room / Area Served	Heat Load (W)	Room air temp (°C)	Room noise level (NR)	Type	Height (mm)	Length (mm)	Depth (mm)	Selected Unit Capacity (W)	Accessories/Special Requirements/Notes
		Per Room				Per Unit			Per Unit	
C1(A)-RAD-004	Bathroom	175	19			450	500	112	555	AR Type Houses to have Wet Radiator. FH Type Houses to have Wet Towel Rail.
House C3(P)										
C3(P)-RAD-001	Master Bedroom	890	19	Refer Note 5	LTHW Radiator	600	1800	112	2540	-
C3(P)-RAD-002	Bedroom 2	485	19			600	900	112	1270	-
C3(P)-RAD-003	Bedroom 3	435	19			600	900	112	1270	-
C3(P)-RAD-004	Bedroom 4	395	19			600	800	112	1130	-
C3(P)-RAD-005	Office	235	19			450	600	112	665	-
C3(P)-RAD-006	Hall	380	19			450	900	112	995	-
House H1(P)										
H1(P)-RAD-001	Master Bedroom	650	19	Refer Note 5	LTHW Radiator	600	1400	112	1975	-
H1(P)-RAD-002	Bedroom 2	565	19			600	1100	112	1550	-
H1(P)-RAD-003	Bedroom 3	430	19			600	900	112	1270	-
H1(P)-RAD-004	Bedroom 4	485	19			600	900	112	1270	-
H1(P)-RAD-005	Office	210	19			450	500	112	555	-
H1(P)-RAD-006	Hall	290	19			450	700	112	775	-
House F1(P)										
F1(P)-RAD-001	Master Bedroom	725	19	Refer Note 5	LTHW Radiator	600	1400	112	1975	-
F1(P)-RAD-002	Bedroom 2	480	19			600	900	112	1270	-
F1(P)-RAD-003	Bedroom 3	445	19			600	900	112	1270	-
F1(P)-RAD-004	Office	130	19			450	500	112	555	-
F1(P)-RAD-005	Hall	215	19			450	500	112	555	-
House F1(A)										
F1(A)-RAD-001	Master Bedroom	710	19	Refer Note 5	LTHW Radiator	600	1400	112	1975	-
F1(A)-RAD-002	Bedroom 2	485	19			600	900	112	1270	-
F1(A)-RAD-003	Bedroom 3	445	19			600	900	112	1270	-
F1(A)-RAD-004	Office	130	19			450	500	112	555	-
F1(A)-RAD-005	Hall	215	19			450	500	112	55	-

House Reference	Room / Area Served	Heat Load (W)	Room air temp (°C)	Room noise level (NR)	Type	Height (mm)	Length (mm)	Depth (mm)	Selected Unit Capacity (W)	Accessories/Special Requirements/Notes
		Per Room				Per Unit			Per Unit	
F1(A)-RAD-006	Bathroom	190	19			450	500	112	5535	AR Type Houses to have Wet Radiator. FH Type Houses to have Wet Towel Rail.
House J1(P)										
J1(P)-RAD-001	Master Bedroom	510	19	Refer Note 5	LTHW Radiator	600	1000	112	1410	-
J1(P)-RAD-002	Bedroom 2	420	19			600	800	112	1130	-
J1(P)-RAD-003	Dining/Living	615	19			600	1200	112	1695	-
J1(P)-RAD-004	Office	120	19			450	500	112	555	-
J1(P)-RAD-005	Hall	370	19			450	900	112	995	-
House K1(A)										
K1(A)-RAD-001	Bathroom	185	19	Refer Note 5	LTHW Radiator	450	500	112	555	AR Type Houses to have Wet Radiator. FH Type Houses to have Wet Towel Rail.
House K2(A)										
K2(A)-RAD-001	Master Bedroom	535	19	Refer Note 5	LTHW Radiator	600	1000	112	1410	
K2(A)-RAD-001	Dining/Living	500	19			600	1000	112	1410	
K2(A)-RAD-001	Hall	265	19			450	700	112	775	
K2(A)-RAD-001	Bathroom	215	19			450	500	112	555	AR Type Houses to have Wet Radiator. FH Type Houses to have Wet Towel Rail.
House H2(P)										
H2(P)-RAD-001	Master Bedroom	600	19	Refer Note 5	LTHW Radiator	600	1100	112	1695	-
H2(P)-RAD-002	Bedroom 2	515	19			600	1000	112	1410	-
H2(P)-RAD-003	Bedroom 3	425	19			600	800	112	1130	-
H2(P)-RAD-004	Bedroom 4	510	19			600	1000	112	1410	-
H2(P)-RAD-005	Office	190	19			450	500	112	555	-
H2(P)-RAD-006	Hall	265	19			450	700	112	775	-
House J1(A)										
J1(A)-RAD-001	Master Bedroom	510	19	Refer Note 5	LTHW Radiator	600	1000	112	1410	-
J1(A)-RAD-002	Bedroom 2	420	19			600	800	112	1130	-
J1(A)-RAD-003	Dining/Living	615	19			600	1200	112	1695	-

House Reference	Room / Area Served	Heat Load (W)	Room air temp (°C)	Room noise level (NR)	Type	Height (mm)	Length (mm)	Depth (mm)	Selected Unit Capacity (W)	Accessories/Special Requirements/Notes
		Per Room				Per Unit			Per Unit	
J1(A)-RAD-004	Office	120	19			450	500	112	555	-
J1(A)-RAD-005	Hall	370	19			450	900	112	995	-
J1(A)-RAD-006	Bathroom	160	19			450	500	112	555	AR Type Houses to have Wet Radiator. FH Type Houses to have Wet Towel Rail.
House K2(P)										
K2(P)-RAD-001	Dining/Living	500	19	Refer Note 5	LTHW Radiator	600	1000	112	1410	-
K2(P)-RAD-002	Master Bedroom	535	19			600	1000	112	1410	-
K2(P)-RAD-003	Hall	195	19			450	500	112	555	-
House B3(A)										
B3(A)-RAD-001	Master Bedroom	900	19	Refer Note 5	LTHW Radiator	600	1800	112	2540	-
B3(A)-RAD-002	Bedroom 2	460	19			600	900	112	1270	-
B3(A)-RAD-003	Bedroom 3	415	19			600	800	112	1130	-
B3(A)-RAD-004	Office	110	19			450	500	112	555	-
B3(A)-RAD-005	Hall	350	19			450	900	112	995	-
B3(A)-RAD-006	Bathroom	190	19			450	500	112	555	AR Type Houses to have Wet Radiator. FH Type Houses to have Wet Towel Rail.
Apartment Type 4A										
4A-A1-RAD-001	Protect Hallways	370	19	Refer Note 5	LTHW Radiator	450	900	112	995	-
4A-A1-RAD-002	Office	125	19			450	500	112	555	-
4A-A1-RAD-003	Master Bedroom	545	19			600	1000	112	1410	-
4A-A1-RAD-004	Bedroom 2	415	19			600	800	112	1130	-
4A-A1-RAD-005	Dining/Living	660	19			600	1400	112	1975	-
4A-A1-RAD-006	Bathroom	160	19			450	500	112	555	AR Type Houses to have Wet Radiator. FH Type Houses to have Wet Towel Rail.
Apartment Type 13										
13-A4-RAD-001	Bathroom	160	19	Refer Note 5	LTHW Radiator	450	500	112	555	-
Apartment Type 15										

House Reference	Room / Area Served	Heat Load (W)	Room air temp (°C)	Room noise level (NR)	Type	Height (mm)	Length (mm)	Depth (mm)	Selected Unit Capacity (W)	Accessories/Special Requirements/Notes
		Per Room				Per Unit			Per Unit	
15-A4-RAD-001	Shower Room	230	19	Refer Note 5	LTHW Radiator	450	600	112	665	-
Apartment Block – Electric Radiator										
A4-RAD-00-001	Base of Staircase	-	19	Refer Note 5	Electric Radiator	430	620	108	1000	-
A4-RAD-00-002	Communal Corridor, L00	-	19	Refer Note 5	Electric Radiator	430	620	108	1000	-
A4-RAD-ZZ-001	Communal Corridor, L01	-	19	Refer Note 5	Electric Radiator	430	620	108	1000	-
A3-RAD-B1-001	Water Plantroom, Block A3, Basement	-	19	Refer Note 5	Electric Radiator	430	620	108	1000	-
A3-RAD-B1-002	Water Plantroom, Block A3, Basement	-	19	Refer Note 5	Electric Radiator	430	620	108	1000	-

Notes

1. Towel Rail & LTHW Radiator selections based on Stelrad, equal and approved. Electric Radiator Selection based on Dimplex, equal and approved.
2. Refer to specification section T20 for materials and workmanship clauses and standards
3. Unit Requirements:
    - Wall Mounted
    - Units to include cable for connection to local fused spur
    - Detachable wall mounted bracket
    - Towel Rails with adjustable temperature setting, Anti-freeze setting and 2-hour boost button.
4. Finish - Metal Chassis, Air Outlet Grille & Control Moulding - Traffic White (RAL 9016)
5. For final room noise rating, refer to the acoustic report.

Room Type	Floor Construction	Space air temp (°C)	Average Heat requirement (W/m^2)	Max floor surface temp (°C)	Max water temp (°C)	Return water temp (°C)	Design Temp drop across manifold (°C)	Max system working pressure (Bar)	Max pressure drop at manifold (kPa)	No manifolds	Note
Living / Dining / Kitchen	Screed	22	35	29	45	35	10	6	See Note 8	1	-
Bedroom	Screed	20	35	29	45	35	10	6	See Note 8		-
Office / Study	Screed	20	35	29	45	35	10	6	See Note 8		-
Hall	Screed	20	35	29	45	35	10	6	See Note 8		-
WC	Screed	20	35	29	45	35	10	6	See Note 8		-

Notes:

1. Selection based on Uponor Manufacturer or equal and approved
2. Refer to clause T20. 310.150

   The specialist contractor shall design, supply, install, test and commission the complete system in accordance with all relevant parts of BS EN 1264 as appropriate. This shall include the provision of the following:
   - Edge insulation on walls
   - Insulation layer
   - Vapour membrane
   - Supports for pipework
   - Pipework to serve the general layout as indicated on the drawings.
3. The areas to be heated are as indicated on the drawings; the specialist contractor shall determine the number of circuits from each manifold.
4. Pipework shall incorporate an oxygen diffusion barrier.
5. Primary heat source – Flow 60°C & Return 36°C.
6. Refer to specification section T20 for materials and workmanship clauses and standards.
7. Pipework material
   - Crosslinked polyethylene (PE-X) BS 7291-3 or all parts of BS EN ISO 15875, Ends plain, and finish – natural
   - or Polybutylene (PB) BS 7291 Part 2 or all parts of BS EN ISO 15876 Ends - plain, and finish – grey
   - or Proprietary plastic multilayer composite system to BS EN ISO 21003

   Two layers of PE-Xc to all parts of BS EN ISO 15875 with EVOH oxygen barrier to DIN 4726.
   - or Metal / plastic multilayer composite system to BS EN ISO 21003.
   - Welded aluminium forming oxygen barrier between inner and outer layers of PE-X to BS EN ISO 15875-2 or PE-RT to BS EN ISO 22391-2, oxygen barrier to DIN 4726.
8. Specialist UFH contractor to include for additional pump if pressure drop across manifold and underfloor heating circuit is more than 20kPa

9. Manifolds to include:
    - isolation valves, test points, air vent and drain points and pressure gauges on flow and return connections.
    - Actuators
    - Locking ring to prevent tampering.
    - Flowmeter on flow bar of the manifold with visible glass for adjustment of the flow between 0.5l/m to 6l/m.
10. Every room to have separate loop and thermostat with temperature sensor to measure room temperature and is to be linked to BMS controller. Thermostat in living room to act as master thermostat.
11. The contractor shall be responsible for sizing the heat emitters to suit the design heat loss of the dwelling individual rooms.
12. Underfloor heating Systems shall be in accordance with BS EN 1264, DIN 4735-4 and DIN 4725-200.
13. A specialist company shall be employed to carry out the design, supply, installation, testing and commissioning of the underfloor heating system instructed by the developer.

APARTMENT REFERENCE	PLOT NUMBER	MVHR TYPE	TRICKLE RATE (L/s)	BOOST RATE (L/s)
Houses				
House A1(P)	For Plot Numbers to various Houses, please refer to Accommodation Schedule	Type 2	26	45
House A1(A)		Type 2	26	45
House A2(P)		Type 2	26	37
House A2(A)		Type 2	26	37
House D1(A)		Type 4	36	57
House D1(P)		Type 4	33	57
House B2(P)		Type 4	33	57
House B2(A)		Type 4	36	57
House B3(P)		Type 3	38	53
House C1(P)		Type 3	39	53
House C3(P)		Type 4	52	61
House H1(P)		Type 4	46	61
House F1(P)		Type 3	38	53
House F1(A)		Type 2	37	45
House J1(P)		Type 2	27	37
House K1(A)		Type 2	19	37
House K2(A)		Type 2	19	37
House H2(P)		Type 4	46	61
House C1(A)		Type 2	39	45
House J1(A)		Type 2	27	37
House K1(P)		Type 2	19	37
House K2(P)		Type 2	19	37
House B3(A)		Type 2	37	45

APARTMENT REFERENCE	PLOT NUMBER	MVHR TYPE	TRICKLE RATE (L/s)	BOOST RATE (L/s)
Apartments				
Type 1	For Plot Numbers to various Houses, please refer to Accommodation Schedule	Type 2	26	43
Type 2		Type 2	19	37
Type 4A		Type 2	26	43
Type 13		Type 2	19	37
Type 15		Type 1	25	29
Water Plantroom, Block A3				
A3-MVHR-00-001	Water Plantroom	Type 5	-	150

*Refer Next Page for MVHR Data

Reference			MVHR Type 01	MVHR Type 02
System			Mechanical Ventilation Unit – Houses & Apartment Block	Mechanical Ventilation Unit – Houses
Location			Refer Schedule	Refer Schedule
Components / configuration			Floor mounted MVHR unit within the loft space with 100% Bypass in houses except K1(A) & K1(P) and Wall Mounted MVHR with 100% Bypass in Apartments and House types K1(A) & K1(P)	
Duty Heat exchanger and fans	Exhaust side	Airflow (m^3/s)	0.029	0.045
		Air entering temp (°C)	Refer to A13sch	Refer to A13sch
		Air Humidity (%RH)	Not controlled	Not controlled
		External static pressure (Pa)	150	200
	Supply side	Airflow (m^3/s)	0.029	0.045
		Air entering temp (°C)	-4	-4
		Air leaving temp (°C)	N/A	N/A
		Air Humidity (%RH)	Not controlled	Not controlled
		External Static Pressure (Pa)	150	200
		Minimum dry heat recovery efficiency (%)	85%	85%
		Sensible or Total	-	-
Supplementary heater battery duty (kW) /			None provided	
Air temperature leaving heater battery (°C)			N/A	
Fan type			TBC	TBC
Motor type			EC/DC	EC/DC
Fan speed control type / detail			Variable Speed	Variable Speed
Maximum unit SPF (W/l/s)			1.30	1.30
Sound levels:			Refer to Acoustic Report for room NR ratings	
Electrical requirements			240V / 1Ph / 50Hz	
Limiting dimensions:			550L x 285D x 640H	785L x 550D x 722H
Controls requirements			Integrally mounted factory fitted PCB with independent control of supply and extract background flow rates, boost speed flow rates, fan failure indication, heat exchanger frost protection, discreet daily run monitor, S/L terminal for 100% boost speed from remote switch and S/L terminal for boost commission level from remote switch and integral humidistat.	
Accessories			MVHR shall be mounted on floor or wall as per the requirement on an anti-vibration pad	

Reference			MVHR Type 03	MVHR Type 04
System			Mechanical Ventilation Unit – Houses	Mechanical Ventilation Unit – Houses
Location			Refer Schedule	Refer Schedule
Components / configuration			Floor mounted MVHR unit within the loft space with 100% Bypass	
Duty Heat exchanger and fans	Exhaust side	Airflow (m^3/s)	0.055	0.061
		Air entering temp (°C)	Refer to A13sch	Refer to A13sch
		Air Humidity (%RH)	Not controlled	Not controlled
		External static pressure (Pa)	200	200
	Supply side	Airflow (m^3/s)	0.055	0.061
		Air entering temp (°C)	-4	-4
		Air leaving temp (°C)	N/A	N/A
		Air Humidity (%RH)	Not controlled	Not controlled
		External Static Pressure (Pa)	200	200
		Minimum dry heat recovery efficiency (%)	85%	85%
		Sensible or Total	-	-
Supplementary heater battery duty (kW) /			None provided	
Air temperature leaving heater battery (°C)			N/A	
Fan type			TBC	TBC
Motor type			EC/DC	EC/DC
Fan speed control type / detail			Variable Speed	Variable Speed
Maximum unit SPF (W/l/s)			1.40	1.40
Sound levels:			Refer to Acoustic Report for room NR ratings	
Electrical requirements			240V / 1Ph / 50Hz	
Limiting dimensions:			555L x 350D x 640H	785L x 550D x 722H
Controls requirements			Integrally mounted factory fitted PCB with independent control of supply and extract background flow rates, boost speed flow rates, fan failure indication, heat exchanger frost protection, discreet daily run monitor, S/L terminal for 100% boost speed from remote switch and S/L terminal for boost commission level from remote switch and integral humidistat.	
Accessories			MVHR shall be mounted on floor or wall as per the requirement on an anti-vibration pad	

Reference			MVHR Type 05
System			Mechanical Ventilation Unit – Water Plantroom, Block A3
Location			Water Plantroom, Block A3
Components / configuration			Ceiling suspended MVHR unit within the plantroom
Duty Heat exchanger and fans	Exhaust side	Airflow (m^3/s)	0.150
		Air entering temp (°C)	Refer to A13sch
		Air Humidity (%RH)	Not controlled
		External static pressure (Pa)	200
	Supply side	Airflow (m^3/s)	0.150
		Air entering temp (°C)	-4
		Air leaving temp (°C)	N/A
		Air Humidity (%RH)	Not controlled
		External Static Pressure (Pa)	200
		Minimum dry heat recovery efficiency (%)	85%
		Sensible or Total	-
Supplementary heater battery duty (kW) /			None provided
Air temperature leaving heater battery (°C)			N/A
Fan type			TBC
Motor type			EC/DC
Fan speed control type / detail			Variable Speed
Maximum unit SPF (W/l/s)			1.6
Sound levels:			Refer to Acoustic Report for room NR ratings
Electrical requirements			240V / 1Ph / 50Hz
Limiting dimensions:			2020L x 1320D x 350H
Controls requirements			Integrally mounted factory fitted PCB, fan failure indication, heat exchanger frost protection, discreet daily run monitor, S/L terminal for 100% boost speed from remote switch and S/L terminal for boost commission level from remote switch and integral humidistat.
Accessories / Note			Leave a gap of 500 mm to enable the Control Panel to be removed and to gain access to the Commissioning Interface and the Main Controller PCB.

*Refer next page for Notes

Notes

1. MVHR selection is based on Vent Axia or equal and approved.
2. Quoted MVHR duties are based on pressure losses external to the unit and on the following equipment air side pressure losses. Before ordering the fans, the trade contractor shall adjust the fan static pressures to suit pressure drops of actual components used in the systems and any changes to the ductwork layout, types / quantities of bends etc from that indicated on the tender drawings.
3. Quoted fan duties include the following commissioning allowances: -

	Low Pressure Systems	Medium & High-Pressure Systems
On Flow Rates	10 %	5%
On Head	20%	15%

4. If the quoted fan sound power levels are exceeded by actual figures of fans selected, then the relevant attenuator insertion loss shall also be increased to maintain the permissible discharge and radiated noise levels.
5. 2 & 4 Pole TEFV, 3-phase, cage induction motors rated for 400 volts, 50 Hz, (outputs 0.75kW and above) shall be High Efficiency having a rated efficiency at full load equal to or greater than the IE2 limit as defined in BS EN 60034-30 unless noted otherwise.
6. Specific Fan Power (SFP) at 25% of design flow rate to be no greater than that achieved at 100% design flow rate
7. All fans with motors larger than 1.1kW shall have variable speed drives
8. Fan data required at commissioning:
    a. Air volume
    b. Motor input power (which for an EC motor must be read from a meter which calculates the real power from the harmonics present
    c. SFP_v for EPC calculations In accordance with BS EN 13779
9. All fans with motors larger than 1.1kW shall have variable speed drives
10. Sound Spectrum Data for the MVHR's at Boost Air Flow is as follows:

MVHR Type	Sound Power Levels (dB re 10-12 W) at design Boost air flow Octave band mid-frequency (Hz)										
		63	125	250	500	1k	2k	4k	8k	Total	dBa @ 3m
Type 1	Extract	59	55	50	47	43	34	25	24	61	31
	Supply	67	70	66	56	55	49	40	36	73	41
	Breakout	49	46	46	46	47	43	35	29	54	30
Type 2	Inlet	47	50	50	46	34	29	27	33	55	29
	Outlet	51	58	56	57	49	42	28	32	62	36
	Breakout	50	50	55	48	42	36	27	33	58	29
Type 3	Inlet	67	61	66	58	52	42	32	27	70	43
	Outlet	72	72	81	64	59	53	45	39	82	52
	Breakout	53	53	64	55	52	48	42	38	65	38
Type 4	Inlet	50	49	56	52	40	35	33	39	59	34
	Outlet	52	57	60	60	55	50	33	33	65	40
	Breakout	55	49	59	54	46	39	33	39	62	34
Type 5	Supply	55	57	51	44	42	36	32	33	60	31
	Discharge	63	73	68	65	58	55	49	43	75	46
	Breakout	56	57	47	40	37	33	28	29	60	25

V32sch – Schedule of Uninterruptible Power Supply

Standards	Refer to clause V32 310.011
Building Description / Application	
System Requirements	
Size Constraints	
Weight limitation	
Input voltage / phase	
Output voltage / phase	
Continuous power (kVA)	
Peak power (kVA)	
Features	. 418. Standby with automatic standby changeover switching
Resilience	419. n+1 420. n+2 421. 2n
Noise limitation	XX dBA at 1m from each surface of equipment enclosure
Type	Small local packaged static unit rated up to 100kVA
Environment	* Normal.
* Unusual service conditions;	
Environmental	
Mechanical	
Installation	* Pluggable Type A. * Pluggable Type B. * Permanently connected.
Input specification	
Rated values;	
AC input voltage	*400 V
AC input voltage tolerance	+10% -14%
Frequency (hz)	50 Hz
Frequency tolerance.	± 1%, with a rate of change of 0.5Hz/s
Number of phases	TP
Input current	* A
Maximum continuous input current	* A
Transformer rectifier duty (V32.310.021)	6 pulse 12 pulse Incorporate phase shifting of input supplies to multi-unit systems to reduce THD(A).
Input current total harmonic distortion	* %
Input power factor	* 0.8
Input neutral requirements	
Input current requirements	12% THD(V) on the input shall not contribute more than 0.6% THD(V) on the output voltage waveform.
Earth leakage current requirements	
Maximum mains voltage unbalance	
Power system configuration	
Protection device characteristics	
All pole isolation	
Standby generation characteristics	
Output specification	
Output dynamic performance classification to BS EN 62040-3, plus BS EN 62040-5-2 for DC output UPS	

V32sch – Schedule of Uninterruptible Power Supply

Rated values	
Output voltage	*230 / 400V Non linear loading capability to provide an output voltage waveform with less than 5% total harmonic distortion when supplying non-linear load, by filter application.
Line drop compensation (V32.310.080)	* Required / Not required
Voltage tolerance Static load conditions	 ±1%
Dynamic load conditions; 50% load step	+/- 5% Recovery to within +/- 2% in 40ms, full recovery within 150ms.
Number of phases	*TP&N
Linear load output current	A
Non linear load output current	A
Maximum load crest factor	3:1
Nominal frequency (hz) and tolerance Static Dynamic (50% load step)	 50Hz ± 0.1% 50Hz ± 1%
Maximum relative harmonic content	
Maximum synchronised frequency range and maximum phase error with bypass	± 1%, 15° Phase error
Nominal frequency range synchronised with bypass	
Rate of change of frequency on synchronising	
Permissible load unbalance	50% phase unbalance with +/- 3.5%V
Phase angle displacement tolerance	+/- 3° phase angle deviation
Permissible power factor range	
Output voltage transient deviation and recovery time	
Efficiency	
Fault clearing capability	400% rated full load current for 1 sec.
Overload capability (based on loss of input supply); 150% 125% 110%	 2 minutes 10 minutes 60 minutes
Current limit identification.	
Static by-pass transfer switch	
Voltage rating	V
Continuous current rates	A
Load power factor	
Interruption time	s
Transfer time	s
Fault clearance capability on bypass	
Load step and load profile	
Unbalanced load	
Loads generating harmonic or dc currents	
Earth condition of output neutral	• Isolated, TN-S output • Means of independent earthing in the event of loss of supply neutral and/or earth in accordance with BS 7671 (IET Wiring Regulations)
Protection co-ordination	
Loads types and rating	
Frequency stability	
Load distribution	
Future expansion	
Redundancy	

Intermediate DC and battery circuit rated values	
Nominal voltage (V) >	
Nominal current (A) >	
Isolation of DC link from input and output	
Earth condition	
Type of in built batteries	
Number	
Rating (Ah)	
Stored energy time	
Restored energy time	
Nominal charging voltage and tolerance	
Charging current limit	
Battery ripple current and voltage	
Battery under and over voltage protection levels	
Battery charging regime	
Battery protection devices	
Remote battery protection requirements	
Remote battery voltage drop	
UPS switches	
Mode	* Transfer. * Tie.
Normal service conditions	
Continuous duty	
UPS system arrangement as defined in BS EN 62040-3:	422. Double Conversion (VFI) - independent of mains voltage and frequency variations, protecting the load against adverse effects from such variations without depleting the energy source. 423. Line interactive (VI) - where the UPS switches from normal mode of operation to battery mode whilst the input voltage is interrupted, and additionally protecting the load from under-voltage or overvoltage applied continuously to the input. 424. Offline (VFD) - where the UPS switches from normal mode of operation to battery mode whilst the input voltage is interrupted. 425. Cascade/Isolated redundant. 426. Parallel redundant 427. n+1. 428. n+2. 429. 2n.
Number of UPS Modules :	
Total	
Normally working in parallel	
UPS rating and performance	
Switch and transfer performance	
Continuous rating :	
All UPS's in operation	
With minimum required number of UPS's in operation	
Duty :	
Full rated load	
Period of autonomy	* 30 minutes
* Single-unit system	Provide UPS equipment comprising one integrated unit for in-dependent operation.
* Multi-unit system	Provide sets of UPS equipment for parallel operation
Number of sets	
Provide system and output control cubicle.	

Battery and charger	* Common. * Separate.
Bypass arrangement	
Enclosure	
Degree of protection (BS 60529)	*IP31 or IP43
Colour	External - Manufacturer's standard Internal - RAL 9010 30% Gloss (white)
Noise	*Limit external noise level to 75 dBA, measured 1m from each surface of the enclosure.
Motor / Generator Set	*Give requirements in this schedule or refer to scope of works / schedules and Y92 for motor details.* *State IE motor efficiency to BS EN 60034-30-1* *Refer to V10 for details of diesel engine / generator*
Bypass System (V32.310.030)	
Automatic Bypass	
Manual Bypass	
UPS Conditioning Bypass	
Control and Indication (V32.310.070)	
Mimic diagram	Provide on systems rated at 6kVA and above Include on each unit a mimic diagram of the main circuit incorporating indicator lights, push-buttons, instruments and alarms to indicate the status of the system.
Type	*Touch screen graphic display *Mimic indicator lamps
Indications	Incoming supply available Battery on boost charge Open/closed state of all circuit-breakers Bypass ON/OFF Transfer to bypass inhibited
Alarms	Incoming supply failure Battery discharged Battery charge failure Battery circuit-breaker or isolator open Overload Cooling fan failure Equipment over temperature Output outside limits Load on bypass supply
Remote alarm / indication panel	
Type	Graphic / Other
Visual indications	System alarm Module alarm (for multi-module systems only)
Audible alarms	Load on UPS system Load on bypass supply Transfer to bypass inhibited Output outside limits System or module in overload
Communication and software	
Shutdown signal to computer network	
Operating system type	

Monitoring	
Integration of UPS into;	
Network	
BMS	
Diagnostics	
Power Converting Equipment	Refer to (V32 310.080)
Batteries and Chargers (V32 310.091)	
Type	~~Lead/acid vented to BS EN 60896-11~~ ~~Lead/acid Plante positive to BS 6290-2~~ ~~Lead/acid pasted plate to BS 6290-3~~ Default text in 310.091 is “unless scheduled otherwise - Lead/acid valve regulated to BS EN 60896-21, BS EN 60896-22” ~~Lithium to~~ ~~BS EN 62619~~ ~~BS EN 62620~~ ~~Vented nickel-cadmium to BS EN 60623.~~
Number of blocks and number of strings	
Battery Housing	Default text in 310.091 is “ Supply ventilated steel battery cubicle with acid-resistant finish” or ~~Supply acid-resistant open-type battery stands.~~
Battery installation class as defined in BS EN IEC 62485-2	Separate dedicated battery room. Separated area of a plant/equipment room. Battery enclosure.
Charger	refer to 310.090 - current-limited constant-voltage charging system from transformer-rectifier
Instruments and meters	State requirements here eg Battery voltmeter Battery ammeter to indicate charge/discharge current Battery autonomy display meter indicating actual load related time in minutes refer to Y71.2151 and Y71.2160A for standards

V40sch – Schedule of Emergency Lighting Central Power Supply Systems

Standards	Refer to V40 clauses
Type	
Application	
Manufacturer and reference	
Type of system	Central power supply (CPS) system. Low power supply (LPS) system.
Battery accommodation	Within composite charger and battery cubicle. In separate cubicle. On separate battery stands.
Battery type	Sealed nickel-cadmium cells to BS EN 61951-1 Sealed nickel-cadmium cells to BS EN 60622. Vented nickel-cadmium cells to BS EN 60623. Lead-acid cells vented to BS EN 60896-1 and BS EN 60896 -11. Lead-acid cells valve regulated to BS EN 60896-21 and BS EN 60896-22. Ensure batteries are selected to meet the requirements of ICEL1009:2000
Battery service life expectancy	10 years for CPS system 5 years for LPS system
Category	Changeover Without interruption Changeover with control switching devices Non-maintained changeover AC output. DC output.
Control switching device arrangement	
Service conditions	
Normal Mains Input	
Unusual Mains Failed (output rating)	
Characteristics	
Voltages	
Input	400V 50Hz 3 phase 4-wire
Output	400V 50Hz 3 phase 4-wire
Load profile	100% load step
Division of load	1
Permissible transfer time	1s
Duration of load	CPS system (hr) xx LPS system 500 W for 3 hr duration or 1500 W for 1 hr duration XXHr, at end of battery life
Battery installation	
Fault clearing capability	?? A BS 88 gG fuse in accordance with BS EN 50171 Clause 6.5.8
Ambient temperature range	
Ambient relative humidity range	

Edit as appropriate

System	
Standards	BS5839-1, relevant parts of BS EN 54 For systems in dwellings: BS 5839-6. See guidance note and end of schedule for Type and Grade For fire protection of electronic equipment installations: BS 6266.
System Category (area by area)	Category M & L3, with Category P2 in the following areas; – Plantrooms – Switchrooms
Connection to Brigade or Central Monitoring Station	Yes – CMS
Form of Communication	BT Line
Interface for communication	Fire alarm panel – Separate terminals
Type of control system	Analogue addressable
Manual Call Points (W50/310.011)	
Mode of operation	Type 'A', except where Type 'B' are identified on the drawings
Indication of operation	None / Alarm flag
Fault indication	None / Dual coloured LED
Protection against accidental operation	None / Hinged perspex cover and "SNAPLATCH" catch that needs to be broken off before the call point cover can be lifted.
Mounting	Flush / Surface
Degree of protection to BS EN 60529	Internally mounted : IP 31, Externally mounted IP 65 or as indicated on the drawings
Hazardous area classification	
Automatic Detectors:	
Point Detectors – General (W50/310.021):	
Mechanical device to restrict detector type	
Detector locking device	
Visible fault indication	
Colour of devices	White
Combined sounder / detector:	
Separate address	
Heat Detectors (W50.310.031):	
Point Type:	
Rate of rise and fixed element temperature detectors:	

Applications:	General Use (Ambient temperatures < 25°C)	High Temperature ((Ambient temperatures < 55°C)	Other uses ?	Other uses ?
Heat response category to BS EN 54-5 :	A2R	CS		

Non-resettable line type to BS EN 54-28	
Applications	
Smoke Detectors (W50/310.041)	Application
Point Type:	
Aspirating Type:	
Optical beam type:	

Duct type:	
Video analysis type:	
Combined smoke and heat detector:	
Radiation (Flame) Detectors (W50/310.051)	None
Point Type:	
Radiation sensitive cells:	
Ultra violet detector:	
Applications	
Wavelength	190 to 260nm
Performance	0.2m natural gas flame at 12m
Response time	<15s
Infra-red detector:	
Applications	
Wavelength	4.1 to 4.8m
Cone of vision	90°
Range for 2MW fire	25m
Multi-sensor detectors (W50/310.061)	Application
Point detectors with combination of smoke and heat sensors	
Point detectors with a combination of carbon monoxide and heat sensors	
Point detectors with a combination of smoke, carbon monoxide and heat sensors	
Sounders (W50/310.071)	
First coincidence	Bell / Electronic Sounder /Klaxon/Siren
Second coincidence	Bell / Electronic Sounder /Klaxon/Siren
Addressable	
Colour of devices	Signal Red
Combined sounder / detector:	
Separate address	
Degree of protection to BS EN 60529	Internally mounted : IP 31, Externally mounted IP 65 or as indicated on the drawings
Hazardous area classification	
Automatic Release Mechanism (W50/310.171)	
Type	
Manufacturer and reference	
Door release	
Category (BS 7273-4)	A, B or C
Type and characteristics:	
Door holder:	Floor / Wall
Mounting	
Door closer:	
Mounting	Overhead / Pull side / Push side
Operation	Automatic / manual / CIE signal / local smoke detector
Actuator	Electromagnetic / Electromechanical / Fluid pressure controlled
Nominal holding force	
Residual force	

Power supply	24V / 230V a.c. / d.c.
Fire Alarm Control and Indicating Equipment (CIE) (W50/310.081)	
Standards	BS 5839-1, BS 5839-6 Annex B Grade ……, BS EN 54-2, BS EN 54-4
Standard functions	Yes
Additional functions	Interface for additional features only
Mounting	Flush / Surface / Semi Flush
Assembly Construction	
Material of Enclosure	
Display components	Mounted on hinged front cover / Behind hinged front panel
Degree of Protection to BS EN 60529	IP43
Accessibility	By a special tool / Key lock etc,..
Enclosure material / finish / Legend Types	
Colour	
Mains Supply Characteristics	230V ac 50Hz
Protective Device	MCB 20 Amps
Power Supply (Charger and Batteries)	Integral, Partially integral / Separate
Backup duration (24 hours is BS requirement)	24 hours, (measured at the end of cell life)
Future Expansion	Allow charger and cell capacity for 20% additional devices on each zone or loop
Indication of origin of alarms	
Zone indication	Integral with CIE Separate panel Graded series of displays LED backlight
Alpha numeric display	
Fields	32 / 80 characters
Number of characters	- Numbered list - Specially prepared plan of building, permanently mounted adjacent to the indicator panel. - Mimic diagram permanently mounted adjacent to indicator panel.
Détection zone location	VDU / LCD and size / resolution
Visual display	
Backup display	
Repeat display	
Printer	
Panel Mounted	Yes / Remote / None
Number of characters / output size	20,24,40,80
Columns	
General	
System processor	Microprocessor based with Modular Software and Deadlock prevention
Execution monitoring in accordance with BS EN 54-2	1 hour cycle
Execution failure safe state	
One man walk test and commissioning feature	Yes
Monitoring circuit	
Configuration data	Non-volatile memory Volatile memory Alterable memory, programmable at Levels 1 and 2. Manual action to be provided at Level3 prior to data change.
Automatic check	1 hour

EEPROM	24 hours Read write programming protection Battery backed ROM / RAM
Configuration updates performed on site	
Configuration data copied on to floppy disc	
System fault protection	No more than 512 detectors affected by the first fault
Maximum number of addressable points controlled by a single processor	200
Key switch positions	– Normal, key free Level 1 – Normal, key trapped Level 1 – Enable Level 2 – Test Display – Scroll – Silence – Sound Alarm – Sound Alert – Reset
Remote Inputs to CIE	– Evacuate – Silence Alarm – Reset – Alert – Class change – Programmable ….
System Configuration	
Capable of operating	– Conventional detectors – Addressable two state detectors – Multi-state addressable detectors – Analogue addressable detectors
Division of addressable loops into zones	One fault not to disable more than 32 detectors
Capacity of addressable loop	
Number of zones	99
Minimum No of Devices (capacity)	
Maximum Number of fully loaded detection loops	
Fault protection by line isolators	– At zone boundaries – At each addressable device – At each addressable sensor
Line isolator operation time	Within 2s of fault
Address allocation	Independent of physical arrangement of loops.
Distributed CIE	
Interfacing	– Other CIE/Systems – Standardise input/output interface for Fire Brigade Panel – Electronic paging systems – Repeater panel (with / without essential controls) – Public Address System – Voice alarm system (control and indicating equipment to BS EN 54-18
Basic System Functions	
Monitor status	– All devices on addressable loops. – Short circuit and Open circuit faults.

- Incorrect addressing.
- Unauthorised device removal or exchange.
- Pre alarm condition.
- Detector contamination.
- Internal connections.
- Interfaces.
- Chargers.
- Battery.
- Remote signaling.

Audible indication

-

Visual Indication Lamps / LED's

- Power on - Green.
- Quiescent condition [.....]
- Fire Alarm - Red.
- Fault Warning - Yellow.
- Disabled/Isolated - Yellow.
- Fire zones - Red per zone.
- Test condition - Yellow.
- Output to fire alarm routing equipment - Red.
- Output to fire protection equipment - Red.
- Output to fault warning routing equipment - Yellow.
- Flashing [.....]
- Steady [.....]

Push Buttons or Switch Controls

- Sound Alarms/Evacuate.
- Silence Alarm
- Audible signal if not reset.
- Silence Control Sounder.
- Test Alarms.
- Reset fire.
- Level 1.
- Combined with control sounder silence at Level 2.
- Lamp Test.
- Cancel Fault Buzzer.
- Keypad.
- QWERTY keyboard and function keys

Access, levels

- Level 1 - No restriction.
- Level 2 - Operator
  - By key.
  - By code
- Level 3 - Servicing
  - By key.
  - By code
- Level 4 - Engineering
  - External device

Zone status indicators

- Alarm
- Fault
- Isolated

Alarm Monitoring Functions:

Interrogate addressable devices

- Order of scanning……

	– Every 2 seconds
Analysis of sensor output against fire algorithms to differentiate between	– Fire conditions
	– Pre-fire conditions
	– Super fire conditions
	– Multiple fire conditions
	– Coincidence detection
	– Transient contamination
	– Permanent contamination
	– Sensor condition
	– Non-fire events
Response to alarm conditions	– For detectors; not to exceed 10 seconds, with output not more that 2 seconds later
	– For Manual Call Points not to exceed [1, 2 or 3] seconds.
Alarm Output Functions	
Monitored output circuits	
Two stage programmable alarm sounder	
Logic outputs	
Audible indication of alarm	– Silenced at Level 1
	– Silenced at Level 2
Alarm controls	– Alarm reset
	– Alarm output silence
	– Alarm Acknowledge
Output to fire protection equipment	
Disable warning at level 3	
Sound outputs	
Alert	- Pulsed tone
Evacuate	– Continuous tone
Special Event	–
Time delay sequences for alarm response	
Silent to alert	
Alert to evacuate	
Silent to user defined tone	
Delay sounder output	
Delay override	
Delay transmission to central station for;	– 2 minutes
	– Inhibit delay if building occupied
	– No delay on activation of manual call point
Alarm Zone Location	– A numbered list.
	– Specially prepared plan of build, permanently mounted adjacent to the indicator panel.
	– Mimic diagram mounted adjacent to indicator panel.
	– Integrated with Detection Zone display
Supervision and Fault Reporting	
Faults to be reported	
Short circuit and Open Circuit;	– Detection loops
	– Sounder cables
	– Conventional Detector Circuits
	– MCP Circuits
	– Ancillary devices circuits

Others	– Voice alarm system – Emergency Communication System (EVS) – Repeat or Secondary Indicators – Un-configured device – Addressable device failure – Device not responding – Double Address – Incorrectly configured device – Detector condition – Detector removed – Sounder condition – Repeater or Remote printer failure – Repeater or Secondary indicators fault – Earth fault – Main Power fault – Standby Power fault. – PSU fault. – Charger fault. – Battery fault. – Battery critical. – Mains failure. – Auxiliary PSU failure. – Total loss of power [.....] – Fuse failure. – Relay Output fault. – System fault [.....] – Signaling fault. – Scanning or interrogation failure. – Processor failure. – Memory check error. – Memory configuration data loss. – Processor failure – Re-initialise, record and reset. – Re-initialise, reset and indicate fault.
Fault Sounder	
Fault Indication	
Silence Fault Warning	– Level 1 – Level 2
Reset	– Automatic – Manual
Fault Output	– On de-energising – Suppress during fire
Zone fault Indicator	
Test Message to define and locate fault	
Monitor status of auxiliary units	
Fault response time	Less than 100seconds
Processor fault count	1000

Auxiliary fault output
Delay generation of event

System Management System (available at Levels as required by BS EN 54-2)
Management Facilities
Isolate and re-connect

- Addressable point
- Detector zone
- Sounder zone
- Remote center signaling

Walk-test of zones to verify detectors and sounders
Interrogate sensor

- Cleanliness
- Condition

Display on alphanumeric display via menu system
Alarm log

- First zone alarm top of field
- Most recent zone alarm
- Total number of alarms
- Alarm scrolling
- Alarm display reversion

System events

- Event log
- Event log capacity

Analysis of sensor data
Interrogation of sensor cleanliness
Loop map connections
Enabled and disabled sensors
Fire plan configuration
Address locations
Initialisation log
Fault Status

- Fault log
- Fault indication suppression override
- Disablement

Point Isolated status
Zone isolated status
Point address status

- Address displayed/printed
  - As numerals
  - As alphanumeric code

Non-fire event status

- Non-fire log.

Zone alarm status.
Zone fault status.
Clear display function for non-fire events.
Cycle or scroll display
Alarm status

- Alarm log.

System events

- Event log.

Print, via menu system

- Normal de-bounced contacts 6 seconds
- Fluctuation contacts (e.g. sprinkler valve flow switches) 40 seconds

- Event log capacity

Current fault and warning logs
Analysis of sensor data
Interrogation of sensor cleanliness
Loop map connections.
Enabled and disabled sensors.
Fire plan configuration.
Address locations.
Initialisation log
Fault status
- Fault log.

Point isolated status.
Zone isolated status
Point address status
- Address displayed/printed
  - As numerals
  - As alphanumeric code

Non-fire event status
- Non-fire log

Weekly system audible and visible warning test (BS 5839-1).
Disable/re-enable at level 2

- Zone
- Fire detection equipment output
- Fault warning routing equipment.
- Sounder.
- Fire alarm routing equipment.
- Addressable points

Isolated devices reset after pre-set time
?? Minutes

Co-incidence detection setting zone by zone
Real time clock adjustment]
Event counter

- Manual display
- Automatic display

Test facilities

Memory check
- Manual
- Automatic
  - Cycle 7 days or less
  - Loop map connections
  - Addressable device label change.
  - Address allocation.

Site configuration updating

Division of addressable loops into zones
CIE programmable

-
- Executable code and mandatory data at Level 4.
- On site.
- With integral keyboard.
- By separate computer xxxxxxxxx.
- Software documentation-xxxxxxxxxxxxxxxx

Communications with remote center

Signals
- Alarm.
- Fault.

Communications link	– Zone indications. – RS 232 – RS 485 – Voice over Internet Protocol (VoIP) – Ethernet – Intranet – Internet
CIE Networking	– Master Terminals xxxxxxxx – Graphics Terminals xxxxxxxxxx – Remote printers xxxxxxxxxxxx – Modem connectionsxxxxxxxxxxxx
Repeater Panel (W50/310.091)	
Standards	BS EN 54-2, BS EN 54-4
Functional Requirements	Fire Brigade Panel – Standardised input/output interface to CIE
Visual display	Repeat indication within 5 seconds of CIE indications CIE Indication CIE Display Clock Alarm Faults Zone alarms Zone faults Transmission to fire alarm routing equipment. Transmission to fire protection equipment Disablement – Sounder. – Fire alarm routing equipment.
Controls	Sound Alarm. Silence audible indication Disable/re-enable sounders Disable/re-enable signals to fire alarm routing equipment. Silence Alarm. Reset fire.
Printer	
Mounting	– Flush. – Surface
Mounting	Flush / Surface / Semi Flush
Assembly Construction	
Material of Enclosure	
Display components	Mounted on hinged front cover / Behind hinged front panel
Degree of Protection to BS EN 60529	IP43
Accessibility	By a special tool / Key lock etc,..
Enclosure material / finish / Legend Types	To match main control and indicating panel
Colour	
Power Supply	From Detection Loop or Local / Integral Power Supply

Mains Supply Characteristics	230V ac 50Hz
Protective Device	MCB 20 Amps
Power Supply (Charger and Batteries)	Integral, Partially integral / Separate
Backup duration (24 hours is BS requirement)	24 hours, (measured at the end of cell life)
Mimic Panel (W50/310.101)	
Standards	BS EN 54-2
Functional Requirements	
Visual display	CIE Indication CIE Display Clock Alarm Faults
Controls	Sound Alarm. Silence audible indication Reset fire.
Site Plan	
Hardware	Laminated plastic colour coded Engraved stainless steel Site re-programmable
Software	Illuminate; – Sensor in fire – Zone in fire
Mimic Construction	LED in each area & each zone LED for each device
Printer	Fireman's Emergency Ventilation Controls
Ancillaries	Fire Officer's Microphone
Mounting	Flush / Surface / Semi Flush
Assembly Construction	
Material of Enclosure	Mounted on hinged front cover / Behind hinged front panel
Display components	IP43
Degree of Protection to BS EN 60529	By a special tool / Key lock etc,..
Accessibility	
Enclosure material / finish / Legend Types	
Colour	
Power Supply	From detection addressable loop or Local / Integral Power Supply
Mains Supply Characteristics	230V ac 50Hz
Protective Device	MCB 20 Amps
Power Supply (Charger and Batteries)	Integral, Partially integral / Separate
Backup duration (24 hours is BS requirement)	24 hours, (measured at the end of cell life)
Fire Alarm System Ancillaries (W50/310.181)	Schedule project requirements e.g. Key box

1. Fireman Service Ventilation Control – 3 position
   Position 2 ‘OFF’ - Ventilation fans off
   Position 3 ‘EXTRACT ONLY’- Smoke extract fans on
   Position 1 ‘AUTOMATIC’ – Ventilation on

Locate switch on or immediately adjacent indicator panel. Position 2 to disconnect all inlet and exhaust fans other than individual toilet extract units. Position 3 to override any local selection of smoke extract fans. Terminate connections separately in indicator panel. External wiring detailed elsewhere (Section W60).

2. Chemical Store controls

Fire-door controls.

In the event of one detector in the chemical store reaching alarm state the external vehicle door and internal doors to shut.

Fire Suppression System

In the event of two detectors in the chemical store reaching alarm state, the fire suppression system shall operate as soon as the doors are shut or in not less than 30 seconds whichever is the soonest.

Interconnecting wiring within the chemical store shall terminate as a junction box adjacent to the personnel door for connection to the indicator panel. Wiring to be carried out under this contract.

BS EN 54-5 Classification of Point Heat Detectors:

Table 1 — Detector classification temperatures

Detector Class	Typical Application Temperature °C	Maximum Application Temperature °C	Minimum Static Response Temperature °C	Maximum Static Response Temperature °C
A1	25	50	54	65
A2	25	50	54	70
B	40	65	69	85
C	55	80	84	100
D	70	95	99	115
E	85	110	114	130
F	100	125	129	145
G	115	140	144	160

In addition to the basic classification, a detector may be given an ‘R’ or ‘S’ suffix. The ‘R’ suffix indicates that the detector has been shown to have a rate-of-rise characteristic. Such a detector will still give a rapid response even when starting from an ambient temperature well below its typical application temperature. This type of detector is therefore suitable for areas such as unheated warehouses in which the ambient temperature may be very low for long periods.

The ‘S’ suffix on the other hand indicates that the detector will not respond below its minimum static response temperature even exposed to high rates of rise of air temperature. This type is therefore suitable for areas such as kitchens and boilers rooms where large, rapid temperature changes are considered normal.

Service	Material	Finish	Joints	Fittings	Notes
Natural Gas (internally) Fuel Oil Compressed air (industrial) Gaseous fire fighting Foam Fire Fighting	Up to 150mm Carbon Steel to BS EN 10255 or BS EN 10217-1 (Heavy). 200mm & above to BS EN 10216-1 (seamless) or BS EN 10217-1 V(Welded)	Black, varnished (Compressed air – galvanised)	Upto 50mm screwed or welded	Malleable cast iron to BS 1562 or wrought steel to BS EN 10242 to suit the application	On natural gas systems carry out non destructive testing on 10% of butt welds and on 5% of welded flanges including pre-fabricated works. Gas pipework installation to be in accordance with IGEM / UP / 2 edition 3 and IGEM / G / 5 (for gas in flats and Multi-dwelling buildings) Ensure that there are flanges adjacent to all items of equipment to allow removal and maintenance. Oversize insulation to be provided to the adjacent pipework where required to maintain the surface when insulating the fittings.
			65mm and above Welded and Flanged	Carbon Steel to BSEN 10253	
			Up to 50mm screwed or grooved	Malleable cast iron	
			65mm and above Welded and Flanged or grooved	Carbon Steel to BSEN 10253	
LTHW LTHW cold Feeds	Up to 150mm Carbon Steel to BS EN 10255 or BS EN 10217-1 (Medium). 200mm & above to BS EN 10216-1 (seamless) or BS EN 10217-1 (Welded)	Black, varnished	Upto 50mm screwed or welded	Malleable cast iron to BS 1562 or wrought steel to BS EN 10242 to suit the application	Ensure that there are flanges adjacent to all items of equipment to allow removal and maintenance. Oversize insulation to be provided to the adjacent pipework where required to maintain the surface when insulating the fittings.
			65mm and Above Welded joints	Carbon Steel to BSEN 10253	
			Up to 50mm screwed or grooved	Malleable cast iron	
			65mm and above Welded and Flanged or grooved	Carbon Steel to BSEN 10253	
Underfloor Heating	PE-Xa or PB to BS 7291-3 or EN ISO 15875 PE-RT to BS EN ISO 22391 or Proprierary Multilayer system to BS EN ISO 21003	Self colour	Fusion welded or compression fittings	Fusion welded to BS BS 7291-3	All systems to incorporate oxygen barrier layer. No joints to be present on UFH system apart from Manifold connection.
Sprinkler Pipe to BS 9251	CPVC to ASTM F442 SDR 13.5	Uncoated	Solvent cement	To match system used	WRAS Approved Pipe, fittings and solvent cement to be resistant to the precence of chlorine dioxide at a concentration of 0.5 mg/l in the domestic water
Dry Risers Wet Risers Wet Riser Drains	Galvanised steel to BS EN 10255 up to 150mm, medium 200mm & above to BS EN 10216 / BS EN 10217	Galvanised	Up to 50mm screwed	Malleable cast iron	Bends and Tees to be long radius type.
			65 to 100mm Flanged	Galvanised wrought steel	
			125mm flanged	Galvanised malleable cast iron	

Service	Material	Finish	Joints	Fittings	Notes
Mains Cold Water Cold Water Down Services Hot Water Services HWS Cold Feed Overflows Warning Pipes Condense drains Hosereel service LTHW final connections ASPs Waste and vent lines 54mm Equipment vent and drain lines for water services	Copper to BS EN 1057 R 250	Uncoated	Up to 108mm lead free integral solder ring 133mm to 159mm Brazed/Flanged	To match system used	Fittings for waste installations shall be waste type, swept in the direction of flow. Grease-based flux shall not be used
Boosted Cold Water Service after HIU in residential apartments/townhouses Hot Water Services i after HIU in residential apartments/townhouses	PE-Xa combi pipe EN ISO 15875-A-PE DVCW Standard W270	Self colour grey	Shrink fit or press fit	Solvent welded BS 5392	WRAS Approved As Upunor Q&E or S-Press or equal Pipe, fittings and jointing material to be resistant to the precence of chlorine dioxide at a concentration of 0.5 mg/l in the domestic water
Boosted Cold Water Residential Rising Mains	Thin wall stainless steel grade 316L/1,444. Stainless steel pressued collars in accordance with BS EN 1092-1 used with metric bore mild steel Akzo Noble Resicoat R4 green coated backing flanges	Uncoated / coated flanges	Flanged	-	Working pressure – PN16 and PN25, as appropriate Include foil faced insulation to complete system
Chlorine Dioxide dosing Recirculation lines	uPVC to BS 3505	Uncoated self colour	Solvent weld	Socket / spigot	

Service	Material	Finish	Joints	Fittings	Notes
Drainage stacks,vent stacks and branch waste and soil pipes	HDPE to BS EN 1519 BBA certified	Uncoated	Electrofusion welded	Mechanical couplings to match system used	Acceptable alternative for branch waste and soil pipes – plastic PVC-U to BS EN 1329-1 / BS 4514 for for system components or requirements not covered by EN 1329-1 complete with socket and spigot for solvent welding System to be insulated for acoustic control – refer to Y50 scope of works or schedules. Fit fire collars in accordance with fire compartmentation and rating requirements
Waste pipes and anti siphon pipes	Up to 80mm, copper to BS EN 1057 R250	uncoated	lead free integral solder	capillary	Acceptable Alternative – plastic PVC-U to BS EN 1329-1 / BS 4514 for for system components or requirements not covered by EN 1329-1 socket and spigot for solvent welding
Soil floats and associated anti sophon pipes	100mm and above, copper to BS EN 1057 R250	uncoated	lead free integral solder	capillary	Acceptable Alternative – plastic PVC-U to BS EN 1329-1 / BS 4514 for for system components or requirements not covered by EN 1329-1 socket and spigot for solvent welding
Vent pipes and anti-siphon pipes associated with discharge stacks	Up to 67mm, Copper to BS EN 1057 R250	uncoated	lead free integral solder	capillary	
Discharge stacks	80mm and above Cast iron to BS EN 877 / BS 416	Hot dipped	Mechanical	Cast Iron to BS 416	
Internal rainwater (buried in external wall)	Cast iron to BS EN 877 / BS 416	Uncoated	Electrofusion welded	Mechanical couplings to match system used	System to be insulated for acoustic control – refer to scope of works or schedules. Fit fire collars in accordance with fire compartmentation and rating requirements
Internal rainwater elsewhere	Up to 67mm Copper to BS EN 1057 R250 80mm & above Cast Iron to BS 416 / BS EN 877 80mm and above. HDPE to BS EN 1519 BBA certified	CI Hot dipped Uncoated	Mechanical Electrofusion Welded	Mechanical couplings to match system used	System to be insulated for acoustic control and prevention of condensation – refer to Y50 scope of works or schedules. Fit fire collars in accordance with fire compartmentation and rating requirements
Reclaimed water (internal) rainwater and greywater (collection)	Up to 67mm Copper to BS EN 1057, 80mm & above Cast Iron to BS 416 / BS EN 877	CI Hot dipped	Mechanical		Acceptable Alternative – plastic PVC-U to BS EN 1329 socket and spigot for solvent welding Comply with WRAS Guidance note 9-02-05 for marking and identification
Reclaimed water internal (distribution)	Up to 110mm OD, PVC-C or PB or PE-X to BS 7291	Self colour	Mechanical or solvent weld	To match pipework std	System selected to be suitable for pressure rating of system – see work section S17 Comply with WRAS Guidance note 9-02-05 for marking and identification
Buried Incoming CWS	PE/AL/PE barrier pipe to BS 8588 Type A WIS 4-32-19	Uncoated self colour blue	Mechanical to match pipe Electrofusion	To match system used	WRAS approved To be laid in sand layer.

Service	Material	Finish	Joints	Fittings	Notes
Burried irrigation pipework	PE/AL/PE barrier pipe to BS 8588 Type A WIS 4-32-19	Uncoated self colour blue	Mechanical to match pipe Electrofusion	To match system used	WRAS approved To be laid in sand layer.
Fire Hydrants	PE/AL/PE barrier pipe to BS 8588 Type A WIS 4-32-19	Uncoated self colour blue	Mechanical to match pipe Electrofusion	To match system used	WRAS approved To be laid in sand layer.
Incoming Natural Gas, and buried natural gas distribution	Polyethylene to Gas Industtry std specification GIS/PL2-2 (SDR to suit pipe size and max operating pressure) Or to BS EN 1555 Or BS ISO 4437:2007	Uncoated Self colour yellow	Fusion welded	Fusion welded	Gas pipework installation to be in accordance with the following IGEM standards: UP/2 edition 3, G/5 (for gas in flats and Multi-dwelling buildings), TD/3 (steel and PE pipelines for gas distribution) and TD/4 PE & steel gas services and service pipework Do not use PE in chemically corrosive soil eg containing tars, oil and other chemicals, instead use steel with cathodic protection with tape wrapping
Ground source energy pipework and connections to borehole heat exchangers	PE100 SDR11 to BS EN 12201 or PE-Xa to BS 7291-3 (up to 40^0C fluid temperatures) PE-Xa to BS 7291-3 for fluid temperatures > 40^0C	Self colour	Fusion welded or compression fittings	Fusion welded or compression fittings	Refer to work section T14 for workmanship requirements. PE-Xa must be used in borehole heat exchangers with solar recharge.
Below ground foul and surface water	To be Specified by drainage engineer	To be Specified by drainage engineer	To be Specified by drainage engineer	To be Specified by drainage engineer	To be Specified by drainage engineer
Industrial Applications	Plastic piping system BS EN ISO 15493 for ABS or PVC BS EN ISO 15494 for PB, PE or PP	Edit to suit particular project	Edit to suit particular project	Edit to suit particular project	Give application State if PVC-U or PVC-C State if PE, PE-RT.PE-X

Service	Operating temp (°C)	Duty	Size	Type (The number in brackets after description refers to Y11 specification clause number)	Accessories & Notes
LTHW CHW Condenser water		Regulation and Commissioning	15mm - 50mm	Bronze Single valve measuring station/ commissioning set (2230A)	Amend if PICV's used – see clause Y11 2423
			65mm & above	Cast Iron Single valve measuring station/ commissioning set (2230C) for globe valve type or 2210 + 2230C for butterfly valve type	Amend if PICV's used – see clause Y11 2423
		Differential pressure control	20mm & above	In-line direct acting (2422)	
		Isolation	15mm – 50mm	DZR lever operated ball valve (2081)	
			65mm & above	Semi lugged butterfly valve (2090z)	EPDM seat. 250mm to be geared
		Radiator isolation	Up to 22mm	Bronze radiator valve with wheelhead (2260 A)	Polished chrome finish
		Radiator regulator	Up to 22mm	As above with lockshield (2260A)	Polished chrome finish
		Radiator temperature control	Up to 22mm	Thermostatic radiator valve (2270)	Polished chrome finish See notes for type of thermostatic head and valve type / pattern
		Drain off	15mm – 25mm	Bronze gland cock (2440A)	Provide with hose union and screw cap
		Strainer	15mm – 50mm	Bronze Y type : Stainless steel screens (2681) Or suction guide / strainer at pump suction (2682)	
			65mm & above	Cast Iron Y type : Stainless steel screens (2681) Or suction guide / strainer at pump suction (2682)	
		Non return/ check	15mm – 50mm	Bronze swing type (2320z)	
			65mm & above	Cast Iron swing type (2330z)	
		Air venting (at high points in distribution pipework)	15mm – 50mm	Bronze gland cock (2470) or Automatic air vents where specifically indicated (2511)	
		Deaerator and dirt separator LPHW (Plant room)	Up to 300mm	Microbubble type (2524) or pressure step vacuum degasser (2521) for static head greater than 15m	Refer to schedule Y11sch4 for detail requirements / duties
		Deaerator and dirt separator CHW (Plant room)	Up to 300mm	Microbubble type (2524) or pressure step vacuum degasser (2521) for static head greater than 5m	Refer to schedule Y11sch4 for detail requirements / duties
LTHW Heating and Hot Water Supply		Safety Valves	15mm – 50mm	Bronze pop safety valve (2430A)	
			65mm & above	C.I. pop safety valve (2430C)	
		Permanent Vents	15mm – 50mm	3 way DZR ball valve (2490)	
			65mm & above	3 way cast iron plug cock (2500A)	
Hot Water Supply and Cold Water Supply	5 - 70	Thermal Isolation	15mm & 22mm	Stop valve. Ball type valves Allen key operated (2081)	WRAS approved or equivalent certification
Hot Water Supply and Cold Water Supply	5 - 70	Pressure Reduction	15mm – 50mm	Direct Acting: Bronze valve with stainless steel integral strainer and pressure adjustment / gauge. With integral low flow system	Size to ensure: Maximum velocity of 2m/s through valve and maximum pressure ratio of 3:1. Where used on hot water ensure suitable for 70°C.

Service	Operating temp (°C)	Duty	Size	Type (The number in brackets after description refers to Y11 specification clause number)	Accessories & Notes
					WRAS approved or equivalent certification Refer to scope of works S10 / S11, schedule S10sch1 or drawings for maximum and minimum operating range Consider Braukmann D06F, D06FH or Cla-Val B90GE-01/LFS or B-NGE90-01/LFS Or equal approved
			50mm and above	Pilot Operated: Main valve material of construction shall be Ductile Iron with Fusion bonded epoxy coating inside/outside. Bronze valve with stainless steel trim with stainless steel tubing and fittings.Integral strainer and pressure adjustment / gauge	Size to ensure: Maximum velocity of 2m/s (noise sensitive areas, otherwise 5 m/s max. through valve and maximum pressure ratio of 3:1. Provided with Low Flow Bypass where necessary. Incorporate suitable design features to maintain stable operation across flow range – to minimise risk of instability. Where used on hot water ensure suitable for 70°C. WRAS approved or equivalent certification Constant outlet pressure required irrespective of flow Refer to scope of works S10 / S11, schedule S10sch1 or drawings for maximum and minimum operating range Consider Cla-Val B90-01/LFS Or equal approved
Hot Water Supply, Cold Water Supply and Reclaimed Water Systems	5 - 70	Motorised shut-off or control valves	15mm and above	Refer to scope of works or drawings	WRAS approved or equivalent certification Valves to be slow closing and sized / selected by the valve manufacture based on the system flow / pressure requirements to ensure they do not induce water hammer over the required operating range
Cold Water Supply	5 - 40	Priority Demand Valve		For domestic fire sprinkler systems	Refer to schedule S10sch1
Hot Water Supply, Cold Water Down Service and Cold Feeds internally	5 - 40	Isolation of individual sanitary appliances for maintenance	15mm-22mm	Servicing valves to BS 6675 (2085z)	WRAS approved or equivalent certification
		Isolation	15mm – 50mm	Stop valve, Ball type, wrench operated (2081)	WRAS approved or equivalent certification
			65mm & above	Semi lugged butterfly valve (2090z)	Nitrile seat, WRAS approved
		Regulation	15mm – 50mm	Bronze DRV (globe type) (2151)	WRAS approved or equivalent certification
			65mm & above	Semi lugged butterfly valve (2090z)	Nitrile seat, WRAS approved or equivalent certification
		Anti-vacuum		To BS EN 14451	WRAS approved or equivalent certification

Service	Operating temp (°C)	Duty	Size	Type (The number in brackets after description refers to Y11 specification clause number)	Accessories & Notes
		Showers	15mm – 35mm	Thermostatically controlled mixing valve	WRAS approved or equivalent certification (refer to clause S11.300.050 and S11 scope of works for details)
Mains Cold Water Internally	5 - 40	Isolation	15mm – 50mm	Stop valve, Ball type, wrench operated (2081)	WRAS approved or equivalent certification
			65mm & above	Semi lugged butterfly valve (2090z)	WRAS approved or equivalent certification
		Isolation (potable water supplies)	15mm – 50mm	Copper alloy stop taps to BSEN 1213 (2015)	WRAS approved or equivalent certification
		Backflow prevention		RPZ valve - Refer to scope of works (2395A,B,C,D)	WRAS approved or equivalent certification
		Anti-vacuum		To BS EN 14451	WRAS approved or equivalent certification
Mains cold water externally	5 - 40	Isolation	15mm to 50mm	C.I. Stop tap to BS 5433	WRAS approved or equivalent certification
			65mm & above	Cast iron sluice valve (2007)	WRAS approved or equivalent certification
Mains Cold Water Supply Softened water and pumped supplies	5 - 40	Float operated valves	15mm to 150mm	Bronze, delayed action valve (2290z)	WRAS approved or equivalent certification Consider Aylesbury Keraflo valve range as alternative
Domestic Water Services Inside and Outside Plantrooms	5 - 40	Drain off	15mm	Bronze gland cock (2440A)	WRAS approved or equivalent certification To be provided with hose union screw cap
Steam / Condensate MTHW, HTHW		Isolation	15mm – 25mm 32mm – 200mm	Bellows sealed forged stop valve or forged carbon steel ball valve (2161) Bellows sealed, stop valve SG iron up to 16 barg Carbon steel above 16 barg	With throttling plug to allow manual regulation to adjust line pressure and flow Screwed or flanged BS EN 1092 Screwed BSP up to 50mm or Flanged BS EN 1092 (all sizes)
		Check valve	15mm – 50mm 65mm & above 25mm & above	Gunmetal lift check valve Stainless steel disc or water check valve Globe stop and check valve, SG iron or steel (2371)	Screwed BSP Suitable for fitting between flanges Discharge from steam generator
		Strainer	15mm – 50mm 65mm – 200mm	Carbon steel Y type Carbon steel Y type	Screwed Flanged
		Steam trap	As indicated on drawings	Refer to schedule S51Sch10 and clause S51:300.003	Refer to schedule S51Sch10
		Steam trap monitoring	As indicated on drawings	Refer to schedule S51Sch10	Refer to schedule S51Sch10
		Air vent	15mm – 50mm	Balanced pressure thermostatic air vent	
		Safe guard overheat protection	25mm – 150mm	Cast steel, balanced 2-port valve, normally open, to close on rise in temperature	Flanged. Valve to be complete with failsafe control system, to close valve by spring mechanism at set point or when capillary ruptures or sensor leaks. Incorporate micro switch for fault indication.
		Separator	15mm – 150mm	Carbon steel baffle type	Consider mechanical coalescing/centrifugal separator where high efficiency is required

Service	Operating temp (°C)	Duty	Size	Type (The number in brackets after description refers to Y11 specification clause number)	Accessories & Notes
		Isolation	15mm – 80mm	Cast steel quarter turn ball valve	

Notes

1. This schedule shall be read in conjunction with the relevant Y11 specification clauses. Where applicable, refer to clause Y11.2127 for standards for thermoplastic valves
2. Valves to be used in, or connected to, water supply pipe systems, above or below ground carrying water intended for human consumption to comply with the relevant parts of BS EN 1074 and BS 5163.
3. **Thermostatic radiator valves**

Type of thermostatic head assembly

- Integral sensor / selector
- Integral temperature selector and remote sensor
- Remote sensor incorporating the selector
- Remote sensor / selector assembly
- Separate remote sensor and selector units
- Stand-alone integral electronic smart thermostat with Bluetooth control
- Integral electronic smart thermostat with facility to control from remote central controller

Valve type / pattern

- Without integrated pre-setting facility
- With integrated pre-setting facility to limit the maximum flow through the valve
- Dynamic pressure independent radiator valve with built-in differential pressure regulator to maintain constant differential pressure / set flow rate

Pattern / connections

- Straight
- Angle

Pump Ref	Service	Pump Type	Duty					Fluid operating Temp		Motor type /efficiency class	Max speed rpm	Electrical		Drive type and location	Notes
			Max flow (l/s)	Min flow (l/s)	System Resistance (kPA)	Max system operating pressure	Closed Valve head (kPA)	Max (°C)	Min (°C)			Running current at design duty (A)	Max starting current (A)		
P1	Secondary LTHW circulation pump (Heating / DHW)	In-line	Duty point to be sized and confirmed by MEP contractor / UFH specialist					65	20	IE3	1500	TBC	TBC	VSD	VV

Notes

1. Quoted pump duties are based on the following pressure loss allowances. Before ordering the pumps, the contractor shall adjust the pump pressures to suit pressure drops of actual components used in the systems and any changes to the layout, and quantities of bends etc from that indicated on the tender drawings. Ensure scheduled volume is provided when operating against resistance of system corrected for changes between specified and selected component resistances.

Item	kPa
3 or 4 Port control valve up to 25mm	10
3 Port control valve heating 32mm & above	15
3 Port control valve cooling 32mm & above	40
2 Port control valve	25
2 Port pressure Independent control valve (PICV)	25
Differential pressure control valve	30
TRV's	5
IV's	1
Commissioning stations up to 50mm	4.5
Commissioning stations 65mm & above	10
NRV's	10
Venturi's	1
Heating coils up to 15kW	10
Heating coils above 15kW	15
Cooling coils up to 15kW	10
Cooling coils above 15kW	40

Strainers	10
Pump flexible connections	1
Basket Filters	35
Combined Deaerator and Dirt separator up to 50l/s	2.5
Combined Deaerator and Dirt separator greater than 50l/s	10
Radiant Panels	0.5
Radiator	2
Fan coil units	10
In duct coils	25
Chilled beams – cooling & heating coil	10
Boilers	25
Chillers	50
Plate Heat exchangers	50
Heat / Energy meters	10

2. Quoted pump duties include the following commissioning allowances:
   Flow rate 10%
   Head 15%
3. Select pumps for optimum efficiency in accordance with clause Y20.1020
4. All twin headed pumps shall be supplied with a matching blanking plate to enable the pump to be operated with a single head fitted during maintenance or replacement of standby motor / impeller.
5. **Variable volume systems.**
   Pumps shall be selected with a steep curve in the anticipated range of the system.
   Variable flow control method
   Centrifugal (glanded type)
   Constant pressure, sensors and controls part of pump / inverter package.
   Proportional control, sensors and controls part of pump / inverter package.
   Quadratic pressure control, sensors and controls part of pump / inverter package.
   Remote sensor control by most remote differential pressure sensor in system (controls not part of pump package)
6. Variable speed drives specified as integrated with the pump - the drive life expectancy shall be no shorter than the motor life expectancy.
   Refer to clause Y72.2191 for standard requirements for VSD's
7. 2 & 4 Pole TEFV, 3-phase, cage induction motors rated for 400 volts, 50 Hz, (outputs 0.75kW and above) shall have a rated efficiency at full load equal to or greater than the IE3 limit as defined in BS EN 60034-30-1 unless noted otherwise.
8. Glandless circulators for heating and HWS circulation (single and twin headed) with motors up to 2.5kW maximum "Energy Efficiency Index" (EEI) to be **0.2** or better in accordance with EC directive 641/2009 and the amendment 622/2012. Pumps to utilise electronically controlled permanent magnet type or EC motor.
9. Centrifugal pumps limiting "Minimum Efficiency Index" (MEI) to be **0.7** or better - in accordance with EC regulation 547/2012
10. **Testing Requirements**:
    Refer to clause Y20.1040
    On site

Hydraulic performance
Acoustic

11 For systems pressure ratings refer to schedule A13 – Common Design Criteria

Ref	Service	Description / type	Capacity	Dimensions / Plate size	Insulation S – On site P – Pre-Insulated	Features eg air gap requirements, Division plate	Fluid Category to Water Supply (water Fittings) Regulations 1999.	Notes / class to BS EN 13280
DWT-BA-GF	Cold Water and Residential Sprinkler services (combined tank) Block A (A1, A2, A3, A4)	Sectional externally flanged	9.6 m3 (minimum effective capacity)	4.2 x 2.7 x 2(h) m	P	Keraflo Float Valve Type KAXSF 1 Screened Overflow Assembly+ Internal Elbow (Type 16) Screened Overflow /Warning Pipe PVC PN16 Stub FlangeAssembly c/w Down elbow Drain Level Switch – low BCW Level Switch – low Level switch – high Temp sensor mount External ladder Raised Valve Box with side access Internal GRP ladder Side access Stainless Steel bolts throughout	1	Combined capacity/tank size to be confirmed by sprinkler contractor and MEP Sub Contractor following full hydraulic calculations in accordance with BS EN 9251:2021 and latest Fire Strategy. Tank measurements are indicative and based in Dewey Waters 15m3 GRP tank (min usable capacity of 9.6m3) considering plantroom height of 2.8m. Keraflo Tanktronic unit (or similar) for tank levels control recommended with BMS connection
DWT-BB-GF	Cold Water Services Block B	Sectional externally flanged	TBC	TBC	P	As above	1	Capacity/tank size to be confirmed by MEP Sub Contractor
DWT-BC-GF	Cold Water Services Block C	Sectional externally flanged	TBC	TBC	P	As above	1	Capacity/tank size to be confirmed by MEP Sub Contractor
DWT-BD-GF	Cold Water Services Block D	Sectional externally flanged	TBC	TBC	P	As above	1	Capacity/tank size to be confirmed by MEP Sub Contractor
DWT-BE-GF	Cold Water Services Block E	Sectional externally flanged	TBC	TBC	P	As above	1	Capacity/tank size to be confirmed by MEP Sub Contractor
DWT-BE-GF	Cold Water Services Block F	Sectional externally flanged	TBC	TBC	P	As above	1	Capacity/tank size to be confirmed by MEP Sub Contractor
DWT-XX-GF	CAT5 Water Service	5 No Packaged units, one per block A, B, C, D, E	-	-	P	1.5” Inlet 2” Outlet Top access Raised valve chamber Weir overflow – Type AB air gap	5	Packaged unit of tank and pumpset, WRAS or equivalent approved. Refer to Water Booster section S10sch3

						DrainS/S frame Low level float switch		

Notes

1. Storage tanks / cisterns shall comply with relevant British Standards and Water Supply (water fittings) Regulations 1999 (England and Wales) or The Water Supply (Water Fittings) Byelaws 2014 (Scotland) or The Water Supply (Water Fittings) Regulations (Northern Ireland) 2009.
2. Manholes – side mounted access hatch
3. Connections
    a. Inlet / control valves
        i. Raised inlet valve chamber / ball valve boxes
        ii. Control valves for tank filling forming part of an electronic tank management system (see note 5 below)
    b. Outlets
    c. Overflows
    d. Warning pipes
    e. Temperature sensors / probes – part of electronic tank management system
    f. Water level switches and alarms - part of electronic tank management system see note 5 or describe type / control
    g. Sampling point 300mm above base of tank
    h. Drain valve on base of tank, minimum size 50mm

4. Ancillaries- comply with clause Y21.3021 and the following:
    a. Division plate as scheduled
    b. External access ladders to be provided adjacent to each access manhole.
    c. Internal access ladder to be provided adjacent to each access manhole.
    d. Hand railing around top of each tank over 1.5m high.
    e. Frost protection immersion heaters and controls

5. Electronic tank management system (typical manufacturer – Keraflo “Tanktronic” system) complete with control panel to provide the following:
    a. Monitor and control water level, pressure and volume
    b. Monitor water temperatures (high and low level)
    c. Two stage alarms for high / low water levels and temperature at high and low level
    d. BMS interface – volt free contacts
    e. Two day battery back up
    f. Panel IP rating

Ref.	System	Damper Type	Damper Size (mm x mm)	BWIC Size (mm x mm)	Free Area (m^2)	Rating Required (hrs)	Accessories Required	Performance Classification	Notes / Control mode of operation
Block A3, Level 00									
A3-FD-00-001	Water Plantroom Fresh Air system, Level 00	Fire Damper	W250 x H200	W300 x H250	0.05	Refer to Architect's fire plans	Electric actuator 24V	E120(Ve $_{i\leftrightarrow o}$)	Access for damper testing / maintenance to be provided
A3-FD-00-002	Water Plantroom Exhaust Air system, Level 00	Fire Damper	W250 x H200	W300 x H250	0.05	Refer to Architect's fire plans	Electric actuator 24V	E120(Ve $_{i\leftrightarrow o}$)S	Access for damper testing / maintenance to be provided
A3-FD-00-003	UPS Room, Supply Air System, Level 00	Fire Damper	W200 x H200	W250 x H250	0.04	Refer to Architect's fire plans	Electric actuator 24V	E120(Ve $_{i\leftrightarrow o}$)S	Access for damper testing / maintenance to be provided
A3-FD-00-004	UPS Room, Extract Air System, Level 00	Fire Damper	W200 x H200	W250 x H250	0.04	Refer to Architect's fire plans	Electric actuator 24V	E120(Ve $_{i\leftrightarrow o}$)S	Access for damper testing / maintenance to be provided

Notes

1. Contractor shall design and install the fire and smoke dampers based on the architectural layout and fire strategy report.
2. Dampers based on – Sertus unless stated otherwise, or equal and approved.
3. The "standard installation solution" proposed by the Contractor must be supported by a valid test report or assessment provided by an approved 3rd party.
4. Installation to be in accordance with the methods detailed in HVAC DW/145
5. Smoke control dampers to be in accordance with BS EN 12101-8 tested to BS EN 1366-10 and classified in accordance with BS EN 13501-4.
6. Fire Dampers are to be tested to BS EN 1366-2 and classified in accordance with BS EN 13501-3.
7. Combined fire / smoke control dampers are to be tested to BS EN 1366-2 and 1366-10 and classified in accordance with BS EN 13501-4.
8. For each motorised fire/smoke damper the manufacturer shall provide a local damper control damper unit (DCU). Panels shall be to a minimum IP54 and include a test switch to facilitate local damper testing. Each DCU will also have on-board Led status indication for power, communication active, damper open & damper closed.
9. Final wiring between DCU and damper to be by BMS or controls specialist.
10. Fire Compartmentation rating to be confirmed from Architectural drawings.

Fan Ref	Fan Location	Area Served	Description / Type	Max / Min Air Vol (m^3/s)	Static Resistance (Pa)	Limiting SFP [W/(l/s)]	Motor / Drive Details					
							Motor η / class	Rating (kW)	Full Load (A)	Speed Control Method	Overall Fan / Motor / Drive η (%)	Electrical Details
T2-A1-FAF-001	Type 02 Apartment	Bedroom	Fresh Air Fan to Mitigate Overheating	0.018	50	0.3	IP44	0.100	1.40	VSD	Refer to Note 13	1 Ph, 50Hz, 230V
T15-A4-FAF-001	Type 15 Apartment			0.027	50	0.3	IP44	0.100	1.40	VSD	Refer to Note 13	1 Ph, 50Hz, 230V

Notes

1. Fan selections based on Vent Axia, equal or approved.
2. Quoted fan duties are based on pressure losses external to the fan unit inclusive of external louvre and on the following equipment air side pressure losses as well which includes the air terminals. Before ordering the fans, the contractor shall adjust the fan static pressures to suit pressure drops of actual components used in the systems and any changes to the ductwork layout, types / quantities of bends etc from that indicated on the tender drawings
3. Quoted fan duties include the following commissioning allowances: -

	Low Pressure Systems	Medium & High Pressure Systems
On Flow Rates	10 %	5%
On Head	20%	15%

4. If the quoted fan sound power levels are exceeded by actual figures of fans selected, then the relevant attenuator insertion loss shall also be increased to maintain the permissible discharge and radiated noise levels.
5. 2 & 4 Pole TEFV, 3-phase, cage induction motors rated for 400 volts, 50 Hz, (outputs 0.75kW and above) shall be High Efficiency having a rated efficiency at full load equal to or greater than the IE3 limit (or IE2 limit if fitted with a VSD) as defined in BS EN 60034-30-1 unless noted otherwise.
6. Specific Fan Power (SFP) at 25% of design flow rate to be no greater than that achieved at 100% design flow rate
7. Overall fan/motor/drive efficiency as defined in BS EN ISO 12759.
8. All fans with motors larger than 1.1kW shall have variable speed drives
9. Demarcation of responsibilities and location of VSD
10. Variable Speed Drive details / BMS interface (0-10V, enable, fault).
11 Refer to clause Y72.2191 for standard requirements for VSD's
12. Fan data required at commissioning:
    I. Air volume
    II. Motor input power (which for an EC motor must be read from a meter which calculates the real power from the harmonics present)
    III. SFP for EPC calculations in accordance with BS EN 13779
13. Regarding motor efficiency, refer to the table below

Motor efficiencies comparison table				
REFER TO CLAUSE Y92 2026 FOR FULL LIST OF MOTOR EFFICIENCY LIMITS (FROM 0.12 – 200Kw) FOR 2, 4, 6 AND 8 Pole motors				
BS EN 60034-30-1				
Power	IE2 %		IE3 %	
kW	2 Pole	4 Pole	2 Pole	4 Pole
0.12	53.6	59.1	60.8	64.8
0.18	60.4	64.7	65.9	69.9
0.20	61.9	65.9	67.2	71.1
0.25	64.8	68.5	69.7	73.5
0.37	69.5	72.7	73.8	77.3
0.40	70.4	73.5	74.6	78.0
0.55	74.1	77.1	77.8	80.8
0.75	77.4	79.6	80.7	82.5
1.1	79.6	81.4	82.7	84.1
1.5	81.3	82.8	84.2	85.3
2.2	83.2	84.3	85.9	86.7
3.0	84.6	85.5	87.1	87.6
4.0	85.8	86.6	88.1	88.6
5.5	87	87.7	89.2	89.6
7.5	88.1	88.7	90.1	90.4
11.0	89.4	89.8	91.2	91.4
15.0	90.3	90.6	91.9	92.1
18.5	90.9	91.2	92.4	92.6
22.0	91.3	91.6	92.7	93
30.0	92	92.3	93.3	93.6
37.0	92.5	92.7	93.7	93.9

Ref	Service	Location	Max Air Flow (m^3/s)	Maximum Resistance (Pa)	Typical Size (mm)(LxWxH)	Dynamic Insertion Loss (dB)								Notes
						63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
House A1(P)														
A1(P)-ATT-001	Type A1(P) House, Exhaust Air Side	House Type A1(P)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-
A1(P)-ATT-002	Type A1(P) House, Supply Air Side	House Type A1(P)	0.045	15	1200x226x148	1	4	17	26	52	55	55	55	-
A1(P)-ATT-003	Type A1(P) House, Extract Air Side	House Type A1(P)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-
A1(P)-ATT-004	Type A1(P) House, Fresh Air Side	House Type A1(P)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-
House A2(P)														
A2(P)-ATT-001	Type A2(P) House, Exhaust Air Side	House Type A2(P)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
A2(P)-ATT-002	Type A2(P) House, Supply Air Side	House Type A2(P)	0.037	15	1200x226x148	1	4	17	26	52	55	55	55	-
A2(P)-ATT-003	Type A2(P) House, Extract Air Side	House Type A2(P)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
A2(P)-ATT-004	Type A2(P) House, Fresh Air Side	House Type A2(P)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
House A1(A)														
A1(A)-ATT-001	Type A1(A) House, Exhaust Air Side	House Type A1(A)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-
A1(A)-ATT-002	Type A1(A) House, Supply Air Side	House Type A1(A)	0.045	15	1200x226x148	1	4	17	26	52	55	55	55	-
A1(A)-ATT-003	Type A1(A) House, Extract Air Side	House Type A1(A)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-
A1(A)-ATT-004	Type A1(A) House, Fresh Air Side	House Type A1(A)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-
House A2(A)														

Ref	Service	Location	Max Air Flow (m^3/s)	Maximum Resistance (Pa)	Typical Size (mm)(LxWxH)	Dynamic Insertion Loss (dB)								Notes
						63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
A2(A)-ATT-001	Type A2(A) House, Exhaust Air Side	House Type A2(A)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
A2(A)-ATT-002	Type A2(A) House, Supply Air Side	House Type A2(A)	0.037	15	1200x226x148	1	4	17	26	52	55	55	55	-
A2(A)-ATT-003	Type A2(A) House, Extract Air Side	House Type A2(A)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
A2(A)-ATT-004	Type A2(A) House, Fresh Air Side	House Type A2(A)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
House D1(A)														
D1(A)-ATT-001	Type D1(A) House, Exhaust Air Side	House Type D1(A)	0.057	15	600x226x148	0	3	8	14	28	40	48	33	-
D1(A)-ATT-002	Type D1(A) House, Supply Air Side	House Type D1(A)	0.057	15	1200x226x148	1	4	17	26	52	55	55	55	-
D1(A)-ATT-003	Type D1(A) House, Extract Air Side	House Type D1(A)	0.057	15	600x226x148	0	3	8	14	28	40	48	33	-
D1(A)-ATT-004	Type D1(A) House, Fresh Air Side	House Type D1(A)	0.057	15	600x226x148	0	3	8	14	28	40	48	33	-
House B2(A)														
B2(A)-ATT-001	Type B2(A) House, Exhaust Air Side	House Type B2(A)	0.057	15	600x226x148	0	3	8	14	28	40	48	33	-
B2(A)-ATT-002	Type B2(A) House, Supply Air Side	House Type B2(A)	0.057	15	1200x226x148	1	4	17	26	52	55	55	55	-
B2(A)-ATT-003	Type B2(A) House, Extract Air Side	House Type B2(A)	0.057	15	600x226x148	0	3	8	14	28	40	48	33	-
B2(A)-ATT-004	Type B2(A) House, Fresh Air Side	House Type B2(A)	0.057	15	600x226x148	0	3	8	14	28	40	48	33	-
House F1(A)														
F1(A)-ATT-001	Type F1(A) House, Exhaust Air Side	House Type F1(A)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-

Ref	Service	Location	Max Air Flow (m^3/s)	Maximum Resistance (Pa)	Typical Size (mm)(LxWxH)	Dynamic Insertion Loss (dB)								Notes
						63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
F1(A)-ATT-002	Type F1(A) House, Supply Air Side	House Type F1(A)	0.045	15	1200x226x148	1	4	17	26	52	55	55	55	-
F1(A)-ATT-003	Type F1(A) House, Extract Air Side	House Type F1(A)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-
F1(A)-ATT-004	Type F1(A) House, Fresh Air Side	House Type F1(A)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-
House J1(P)														
J1(P)-ATT-001	Type J1(P) House, Exhaust Air Side	House Type J1(P)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
J1(P)-ATT-002	Type J1(P) House, Supply Air Side	House Type J1(P)	0.037	15	1200x226x148	1	4	17	26	52	55	55	55	-
J1(P)-ATT-003	Type J1(P) House, Extract Air Side	House Type J1(P)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
J1(P)-ATT-004	Type J1(P) House, Fresh Air Side	House Type J1(P)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
House K1(A)														
K1(A)-ATT-001	Type K1(A) House, Exhaust Air Side	House Type K1(A)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
K1(A)-ATT-002	Type K1(A) House, Supply Air Side	House Type K1(A)	0.037	15	1200x226x148	1	4	17	26	52	55	55	55	-
K1(A)-ATT-003	Type K1(A) House, Extract Air Side	House Type K1(A)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
K1(A)-ATT-004	Type K1(A) House, Fresh Air Side	House Type K1(A)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
House K2(A)														
K2(A)-ATT-001	Type K2(A) House, Exhaust Air Side	House Type K2(A)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
K2(A)-ATT-002	Type K2(A) House, Supply Air Side	House Type K2(A)	0.037	15	1200x226x148	1	4	17	26	52	55	55	55	-

Ref	Service	Location	Max Air Flow (m^3/s)	Maximum Resistance (Pa)	Typical Size (mm)(LxWxH)	Dynamic Insertion Loss (dB)								Notes
						63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
K2(A)-ATT-003	Type K2(A) House, Extract Air Side	House Type K2(A)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
K2(A)-ATT-004	Type K2(A) House, Fresh Air Side	House Type K2(A)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
House B2(P)														
B2(P)-ATT-001	Type B2(P) House, Exhaust Air Side	House Type B2(P)	0.057	15	600x226x148	0	3	8	14	28	40	48	33	-
B2(P)-ATT-002	Type B2(P) House, Supply Air Side	House Type B2(P)	0.057	15	1200x226x148	1	4	17	26	52	55	55	55	-
B2(P)-ATT-003	Type B2(P) House, Extract Air Side	House Type B2(P)	0.057	15	600x226x148	0	3	8	14	28	40	48	33	-
B2(P)-ATT-004	Type B2(P) House, Fresh Air Side	House Type B2(P)	0.057	15	600x226x148	0	3	8	14	28	40	48	33	-
House D1(P)														
D1(P)-ATT-001	Type D1(P) House, Exhaust Air Side	House Type D1(P)	0.057	15	600x226x148	0	3	8	14	28	40	48	33	-
D1(P)-ATT-002	Type D1(P) House, Supply Air Side	House Type D1(P)	0.057	15	1200x226x148	1	4	17	26	52	55	55	55	-
D1(P)-ATT-003	Type D1(P) House, Extract Air Side	House Type D1(P)	0.057	15	600x226x148	0	3	8	14	28	40	48	33	-
D1(P)-ATT-004	Type D1(P) House, Fresh Air Side	House Type D1(P)	0.057	15	600x226x148	0	3	8	14	28	40	48	33	-
House F1(P)														
F1(P)-ATT-001	Type F1(P) House, Exhaust Air Side	House Type F1(P)	0.053	15	600x226x148	0	3	8	14	28	40	48	33	-
F1(P)-ATT-002	Type F1(P) House, Supply Air Side	House Type F1(P)	0.053	15	1200x226x148	1	4	17	26	52	55	55	55	-
F1(P)-ATT-003	Type F1(P) House, Extract Air Side	House Type F1(P)	0.053	15	600x226x148	0	3	8	14	28	40	48	33	-

Ref	Service	Location	Max Air Flow (m^3/s)	Maximum Resistance (Pa)	Typical Size (mm)(LxWxH)	Dynamic Insertion Loss (dB)								Notes
						63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
F1(P)-ATT-004	Type F1(P) House, Fresh Air Side	House Type F1(P)	0.053	15	600x226x148	0	3	8	14	28	40	48	33	-
House B3(P)														
B3(P)-ATT-001	Type B3(P) House, Exhaust Air Side	House Type B3(P)	0.053	15	600x226x148	0	3	8	14	28	40	48	33	-
B3(P)-ATT-002	Type B3(P) House, Supply Air Side	House Type B3(P)	0.053	15	1200x226x148	1	4	17	26	52	55	55	55	-
B3(P)-ATT-003	Type B3(P) House, Extract Air Side	House Type B3(P)	0.053	15	600x226x148	0	3	8	14	28	40	48	33	-
B3(P)-ATT-004	Type B3(P) House, Fresh Air Side	House Type B3(P)	0.053	15	600x226x148	0	3	8	14	28	40	48	33	-
House C1(P)														
C1(P)-ATT-001	Type C1(P) House, Exhaust Air Side	House Type C1(P)	0.053	15	600x226x148	0	3	8	14	28	40	48	33	-
C1(P)-ATT-002	Type C1(P) House, Supply Air Side	House Type C1(P)	0.053	15	1200x226x148	1	4	17	26	52	55	55	55	-
C1(P)-ATT-003	Type C1(P) House, Extract Air Side	House Type C1(P)	0.053	15	600x226x148	0	3	8	14	28	40	48	33	-
C1(P)-ATT-004	Type C1(P) House, Fresh Air Side	House Type C1(P)	0.053	15	600x226x148	0	3	8	14	28	40	48	33	-
House H1(P)														
H1(P)-ATT-001	Type H1(P) House, Exhaust Air Side	House Type H1(P)	0.061	18	600x226x148	0	3	8	14	28	40	48	33	-
H1(P)-ATT-002	Type H1(P) House, Supply Air Side	House Type H1(P)	0.061	18	1200x226x148	1	4	17	26	52	55	55	55	-
H1(P)-ATT-003	Type H1(P) House, Extract Air Side	House Type H1(P)	0.061	18	600x226x148	0	3	8	14	28	40	48	33	-
H1(P)-ATT-004	Type H1(P) House, Fresh Air Side	House Type H1(P)	0.061	18	600x226x148	0	3	8	14	28	40	48	33	-

Ref	Service	Location	Max Air Flow (m^3/s)	Maximum Resistance (Pa)	Typical Size (mm)(LxWxH)	Dynamic Insertion Loss (dB)								Notes
						63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
House H2(P)														
H2(P)-ATT-001	Type H2(P) House, Exhaust Air Side	House Type H2(P)	0.061	18	600x226x148	0	3	8	14	28	40	48	33	-
H2(P)-ATT-002	Type H2(P) House, Supply Air Side	House Type H2(P)	0.061	18	1200x226x148	1	4	17	26	52	55	55	55	-
H2(P)-ATT-003	Type H2(P) House, Extract Air Side	House Type H2(P)	0.061	18	600x226x148	0	3	8	14	28	40	48	33	-
H2(P)-ATT-004	Type H2(P) House, Fresh Air Side	House Type H2(P)	0.061	18	600x226x148	0	3	8	14	28	40	48	33	-
House C3(P)														
C3(P)-ATT-001	Type C3(P) House, Exhaust Air Side	House Type C3(P)	0.061	18	600x226x148	0	3	8	14	28	40	48	33	-
C3(P)-ATT-002	Type C3(P) House, Supply Air Side	House Type C3(P)	0.061	18	1200x226x148	1	4	17	26	52	55	55	55	-
C3(P)-ATT-003	Type C3(P) House, Extract Air Side	House Type C3(P)	0.061	18	600x226x148	0	3	8	14	28	40	48	33	-
C3(P)-ATT-004	Type C3(P) House, Fresh Air Side	House Type C3(P)	0.061	18	600x226x148	0	3	8	14	28	40	48	33	-
House C1(A)														
C1(A)-ATT-001	Type C1(A) House, Exhaust Air Side	House Type C1(A)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-
C1(A)-ATT-002	Type C1(A) House, Supply Air Side	House Type C1(A)	0.045	15	1200x226x148	1	4	17	26	52	55	55	55	-
C1(A)-ATT-003	Type C1(A) House, Extract Air Side	House Type C1(A)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-
C1(A)-ATT-004	Type C1(A) House, Fresh Air Side	House Type C1(A)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-
House J1(A)														

Ref	Service	Location	Max Air Flow (m^3/s)	Maximum Resistance (Pa)	Typical Size (mm)(LxWxH)	Dynamic Insertion Loss (dB)								Notes
						63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
J1(A)-ATT-001	Type J1(A) House, Exhaust Air Side	House Type J1(A)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
J1(A)-ATT-002	Type J1(A) House, Supply Air Side	House Type J1(A)	0.037	15	1200x226x148	1	4	17	26	52	55	55	55	-
J1(A)-ATT-003	Type J1(A) House, Extract Air Side	House Type J1(A)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
J1(A)-ATT-004	Type J1(A) House, Fresh Air Side	House Type J1(A)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
House K1(P)														
K1(P)-ATT-001	Type K1(P) House, Exhaust Air Side	House Type K1(P)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
K1(P)-ATT-002	Type K1(P) House, Supply Air Side	House Type K1(P)	0.037	15	1200x226x148	1	4	17	26	52	55	55	55	-
K1(P)-ATT-003	Type K1(P) House, Extract Air Side	House Type K1(P)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
K1(P)-ATT-004	Type K1(P) House, Fresh Air Side	House Type K1(P)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
House K2(P)														
K2(P)-ATT-001	Type K2(P) House, Exhaust Air Side	House Type K2(P)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
K2(P)-ATT-002	Type K2(P) House, Supply Air Side	House Type K2(P)	0.037	15	1200x226x148	1	4	17	26	52	55	55	55	-
K2(P)-ATT-003	Type K2(P) House, Extract Air Side	House Type K2(P)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
K2(P)-ATT-004	Type K2(P) House, Fresh Air Side	House Type K2(P)	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
House B3(A)														

Ref	Service	Location	Max Air Flow (m^3/s)	Maximum Resistance (Pa)	Typical Size (mm)(LxWxH)	Dynamic Insertion Loss (dB)								Notes
						63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
B3(A)-ATT-001	Type B3(A) House, Exhaust Air Side	House Type B3(A)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-
B3(A)-ATT-002	Type B3(A) House, Supply Air Side	House Type B3(A)	0.045	15	1200x226x148	1	4	17	26	52	55	55	55	-
B3(A)-ATT-003	Type B3(A) House, Extract Air Side	House Type B3(A)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-
B3(A)-ATT-004	Type B3(A) House, Fresh Air Side	House Type B3(A)	0.045	15	600x226x148	0	3	8	14	28	40	48	33	-
Apartment Type 01														
T1-A1-ATT-001	Type 01 Apartment, Supply Air Side	Apartment Block, Type 01	0.043	15	1200x226x148	1	4	17	26	52	55	55	55	-
T1-A1-ATT-002	Type 01 Apartment, Extract Air Side	Apartment Block, Type 01	0.043	15	600x226x148	0	3	8	14	28	40	48	33	-
T1-A1-ATT-003	Type 01 Apartment, Exhaust Air Side	Apartment Block, Type 01	0.043	15	600x226x148	0	3	8	14	28	40	48	33	-
T1-A1-ATT-004	Type 01 Apartment, Fresh Air Side	Apartment Block, Type 01	0.043	15	600x226x148	0	3	8	14	28	40	48	33	-
Apartment Type 02														
T2-A1-ATT-001	Type 02 Apartment, Supply Air Side	Apartment Block, Type 02	0.037	15	1200x226x148	1	4	17	26	52	55	55	55	-
T2-A1-ATT-002	Type 02 Apartment, Extract Air Side	Apartment Block, Type 02	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
T2-A1-ATT-003	Type 02 Apartment, Exhaust Air Side	Apartment Block, Type 02	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
T2-A1-ATT-004	Type 02 Apartment, Fresh Air Side	Apartment Block, Type 02	0.053	15	600x226x148	0	3	8	14	28	40	48	33	-
Apartment Type 4A														
4A-A1-ATT-001	Type 4A Apartment, Supply Air Side	Apartment Block, Type 4A	0.043	15	1200x226x148	1	4	17	26	52	55	55	55	-

Ref	Service	Location	Max Air Flow (m^3/s)	Maximum Resistance (Pa)	Typical Size (mm)(LxWxH)	Dynamic Insertion Loss (dB)								Notes
						63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
4A-A1-ATT-002	Type 4A Apartment, Extract Air Side	Apartment Block, Type 4A	0.043	15	600x226x148	0	3	8	14	28	40	48	33	-
4A-A1-ATT-003	Type 4A Apartment, Exhaust Air Side	Apartment Block, Type 4A	0.043	15	600x226x148	0	3	8	14	28	40	48	33	-
4A-A1-ATT-004	Type 4A Apartment, Fresh Air Side	Apartment Block, Type 4A	0.043	15	600x226x148	0	3	8	14	28	40	48	33	-
Apartment Type 13														
13-A4-ATT-001	Type 13 Apartment, Supply Air Side	Apartment Block, Type 13	0.037	15	1200x226x148	1	4	17	26	52	55	55	55	-
13-A4-ATT-002	Type 13 Apartment, Extract Air Side	Apartment Block, Type 13	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
13-A4-ATT-003	Type 13 Apartment, Exhaust Air Side	Apartment Block, Type 13	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
13-A4-ATT-004	Type 13 Apartment, Fresh Air Side	Apartment Block, Type 13	0.037	15	600x226x148	0	3	8	14	28	40	48	33	-
Apartment Type 15														
T15-A4-ATT-001	Type 15 Apartment, Supply Air Side	Apartment Block, Type 15	0.029	15	1200x226x148	1	4	17	26	52	55	55	55	-
T15-A4-ATT-002	Type 15 Apartment, Extract Air Side	Apartment Block, Type 15	0.029	15	600x226x148	0	3	8	14	28	40	48	33	-
T15-A4-ATT-003	Type 15 Apartment, Exhaust Air Side	Apartment Block, Type 15	0.029	15	600x226x148	0	3	8	14	28	40	48	33	-
T15-A4-ATT-004	Type 15 Apartment, Fresh Air Side	Apartment Block, Type 15	0.053	15	600x226x148	0	3	8	14	28	40	48	33	-
Water Plantroom														
A3-ATT-00-001	Water Plantroom, Fresh Air Intake	Water Plantroom, Block A3	0.150	15	600x250x200	2	4	8	16	32	29	26	15	-
A3-ATT-00-002	Water Plantroom, Exhaust Air	Water Plantroom, Block A3	0.150	15	600x250x200	2	4	8	16	32	29	26	15	-

Ref	Service	Location	Max Air Flow (m^3/s)	Maximum Resistance (Pa)	Typical Size (mm)(LxWxH)	Dynamic Insertion Loss (dB)								Notes
						63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
A3-ATT-00-003	Water Plantroom, Supply Air	Water Plantroom, Block A3	0.150	15	900x250x200	4	9	16	28	46	42	36	22	-
A3-ATT-00-001	Water Plantroom, Extract Air	Water Plantroom, Block A3	0.150	15	900x250x200	4	9	16	28	46	42	36	22	

Notes

1. Selections based on Caice, or equal and approved.
2. Contractor to confirm selected equipment inlet and outlet sound power levels and adjust attenuator insertion loss as necessary.
3. Attenuators to be delivered to site with capped ends to prevent ingress of dirt prior to installation.
4. For final room noise rating, refer to the acoustic report.

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
House Type A1(P)									
A1(P)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(P) Houses)
A1(P)-SG-002	Master Bedroom	Circular	Powder	125Ø	10	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(P) Houses)
A1(P)-SG-003	Bedroom 02	Circular	Powder	125Ø	9	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(P) Houses)
A1(P)-SG-004	Dining	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(P) Houses)
A1(P)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(P) Houses)
A1(P)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(P) Houses)
A1(P)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(P) Houses)
A1(P)-EG-004	WC	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(P) Houses)
A1(P)-EG-005	Store with WM	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(P) Houses)
House Type A2(P)									
A2(P)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(P) Houses)
A2(P)-SG-002	Master Bedroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(P) Houses)
A2(P)-SG-003	Bedroom 02	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(P) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
A2(P)-SG-004	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(P) Houses)
A2(P)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(P) Houses)
A2(P)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(P) Houses)
A2(P)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(P) Houses)
A2(P)-EG-004	WC	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(P) Houses)
House Type A1(A)									
A1(A)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(A) Houses)
A1(A)-SG-002	Master Bedroom	Circular	Powder	125Ø	10	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(A) Houses)
A1(A)-SG-003	Bedroom 02	Circular	Powder	125Ø	9	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(A) Houses)
A1(A)-SG-004	Dining	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(A) Houses)
A1(A)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(A) Houses)
A1(A)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(A) Houses)
A1(A)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(A) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
A1(A)-EG-004	WC	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(A) Houses)
A1(A)-EG-005	Store with WM	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A1(A) Houses)
House Type A2(A)									
A2(A)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(A) Houses)
A2(A)-SG-002	Master Bedroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(A) Houses)
A2(A)-SG-003	Bedroom 02	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(A) Houses)
A2(A)-SG-004	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(A) Houses)
A2(A)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(A) Houses)
A2(A)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(A) Houses)
A2(A)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(A) Houses)
A2(A)-EG-004	WC	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type A2(A) Houses)
House Type D1(A)									
D1(A)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(A) Houses)
D1(A)-SG-002	Master Bedroom	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(A) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
D1(A)-SG-003	Bedroom 3	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(A) Houses)
D1(A)-SG-004	Bedroom 2	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(A) Houses)
D1(A)-SG-005	Office	Circular	Powder	125Ø	20	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(A) Houses)
D1(A)-SG-006	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(A) Houses)
D1(A)-EG-001	M&E Store	Circular	Powder	125Ø	11	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(A) Houses)
D1(A)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(A) Houses)
D1(A)-EG-003	Bathroom	Circular	Powder	125Ø	11	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(A) Houses)
D1(A)-EG-004	WC	Circular	Powder	125Ø	11	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(A) Houses)
D1(A)-EG-005	Store with WM	Circular	Powder	125Ø	11	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(A) Houses)
House Type B2(A)									
B2(A)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(A) Houses)
B2(A)-SG-002	Master Bedroom	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(A) Houses)
B2(A)-SG-003	Bedroom 2	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(A) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
B2(A)-SG-004	Bedroom 3	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(A) Houses)
B2(A)-SG-005	Office	Circular	Powder	125Ø	20	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(A) Houses)
B2(A)-SG-006	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(A) Houses)
B2(A)-EG-001	M&E Store	Circular	Powder	125Ø	11	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(A) Houses)
B2(A)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(A) Houses)
B2(A)-EG-003	Bathroom	Circular	Powder	125Ø	11	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(A) Houses)
B2(A)-EG-004	WC	Circular	Powder	125Ø	11	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(A) Houses)
B2(A)-EG-005	Store with WM	Circular	Powder	125Ø	11	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(A) Houses)
House Type F1(A)									
F1(A)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(A) Houses)
F1(A)-SG-002	Master Bedroom	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(A) Houses)
F1(A)-SG-003	Bedroom 2	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(A) Houses)
F1(A)-SG-004	Bedroom 3	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(A) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
F1(A)-SG-005	Office	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(A) Houses)
F1(A)-SG-006	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(A) Houses)
F1(A)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(A) Houses)
F1(A)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(A) Houses)
F1(A)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(A) Houses)
F1(A)-EG-004	WC	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(A) Houses)
F1(A)-EG-005	Store with WM	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(A) Houses)
House Type K1(A)									
K1(A)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K1(A) Houses)
K1(A)-SG-002	Master Bedroom	Circular	Powder	125Ø	24	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K1(A) Houses)
K1(A)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K1(A) Houses)
K1(A)-EG-002	Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K1(A) Houses)
K1(A)-EG-003	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K1(A) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
K1(A)-EG-004	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K1(A) Houses)
House Type K2(A)									
K2(A)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K2(A) Houses)
K2(A)-SG-002	Master Bedroom	Circular	Powder	125Ø	24	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K2(A) Houses)
K2(A)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K2(A) Houses)
K2(A)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K2(A) Houses)
K2(A)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K2(A) Houses)
K2(A)-EG-004	Store with WM	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K2(A) Houses)
House Type J1(P)									
J1(P)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(P) Houses)
J1(P)-SG-002	Master Bedroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(P) Houses)
J1(P)-SG-003	Bedroom 2	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(P) Houses)
J1(P)-SG-004	Office	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(P) Houses)
J1(P)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(P) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
J1(P)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(P) Houses)
J1(P)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(P) Houses)
J1(P)-EG-004	Store with WM	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(P) Houses)
House Type B2(P)									
B2(P)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(P) Houses)
B2(P)-SG-002	Bedroom 3	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(P) Houses)
B2(P)-SG-003	Master Bedroom	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(P) Houses)
B2(P)-SG-004	Bedroom 2	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(P) Houses)
B2(P)-SG-005	Office	Circular	Powder	125Ø	20	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(P) Houses)
B2(P)-SG-006	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(P) Houses)
B2(P)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(P) Houses)
B2(P)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(P) Houses)
B2(P)-EG-003	EnSuite	Circular	Powder	125Ø	9	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(P) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
B2(P)-EG-004	Bathroom	Circular	Powder	125Ø	9	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(P) Houses)
B2(P)-EG-005	WC	Circular	Powder	125Ø	9	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(P) Houses)
B2(P)-EG-006	Store with WM	Circular	Powder	125Ø	9	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B2(P) Houses)
House Type D1(P)									
D1(P)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(P) Houses)
D1(P)-SG-002	Master Bedroom	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(P) Houses)
D1(P)-SG-003	Bedroom 2	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(P) Houses)
D1(P)-SG-004	Bedroom 3	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(P) Houses)
D1(P)-SG-005	Office	Circular	Powder	125Ø	20	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(P) Houses)
D1(P)-SG-006	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(P) Houses)
D1(P)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(P) Houses)
D1(P)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(P) Houses)
D1(P)-EG-003	Bathroom	Circular	Powder	125Ø	9	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(P) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
D1(P)-EG-004	EnSuite	Circular	Powder	125Ø	9	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(P) Houses)
D1(P)-EG-005	WC	Circular	Powder	125Ø	9	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(P) Houses)
D1(P)-EG-006	Store with WM	Circular	Powder	125Ø	9	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type D1(P) Houses)
House Type F1(P)									
F1(P)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(P) Houses)
F1(P)-SG-002	Master Bedroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(P) Houses)
F1(P)-SG-003	Bedroom 2	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(P) Houses)
F1(P)-SG-004	Bedroom 3	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(P) Houses)
F1(P)-SG-005	Office	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(P) Houses)
F1(P)-SG-006	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(P) Houses)
F1(P)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(P) Houses)
F1(P)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(P) Houses)
F1(P)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(P) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
F1(P)-EG-004	EnSuite	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(P) Houses)
F1(P)-EG-005	WC	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(P) Houses)
F1(P)-EG-006	Store with WM	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type F1(P) Houses)
House Type B3(P)									
B3(P)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(P) Houses)
B3(P)-SG-002	Master Bedroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(P) Houses)
B3(P)-SG-003	Bedroom 2	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(P) Houses)
B3(P)-SG-004	Bedroom 3	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(P) Houses)
B3(P)-SG-005	Office	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(P) Houses)
B3(P)-SG-006	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(P) Houses)
B3(P)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(P) Houses)
B3(P)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(P) Houses)
B3(P)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(P) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
B3(P)-EG-004	EnSuite	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(P) Houses)
B3(P)-EG-005	WC	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(P) Houses)
B3(P)-EG-006	Store with WM	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(P) Houses)
House Type C1(P)									
C1(P)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(P) Houses)
C1(P)-SG-002	Master Bedroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(P) Houses)
C1(P)-SG-003	Bedroom 2	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(P) Houses)
C1(P)-SG-004	Bedroom 3	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(P) Houses)
C1(P)-SG-005	Office / Study	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(P) Houses)
C1(P)-SG-006	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(P) Houses)
C1(P)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(P) Houses)
C1(P)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(P) Houses)
C1(P)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(P) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
C1(P)-EG-004	EnSuite	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(P) Houses)
C1(P)-EG-005	WC	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(P) Houses)
C1(P)-EG-006	Utility	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(P) Houses)
House Type H1(P)									
H1(P)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H1(P) Houses)
H1(P)-SG-002	Master Bedroom	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H1(P) Houses)
H1(P)-SG-003	Bedroom 2	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H1(P) Houses)
H1(P)-SG-004	Bedroom 3	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H1(P) Houses)
H1(P)-SG-005	Bedroom 4	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H1(P) Houses)
H1(P)-SG-006	Office	Circular	Powder	125Ø	20	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H1(P) Houses)
H1(P)-SG-007	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H1(P) Houses)
H1(P)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H1(P) Houses)
H1(P)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H1(P) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
H1(P)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H1(P) Houses)
H1(P)-EG-004	EnSuite	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H1(P) Houses)
H1(P)-EG-005	EnSuite	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H1(P) Houses)
H1(P)-EG-006	WC	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H1(P) Houses)
H1(P)-EG-007	Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H1(P) Houses)
House Type H2(P)									
H2(P)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H2(P) Houses)
H2(P)-SG-002	Master Bedroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H2(P) Houses)
H2(P)-SG-003	Bedroom 2	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H2(P) Houses)
H2(P)-SG-004	Bedroom 3	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H2(P) Houses)
H2(P)-SG-005	Bedroom 4	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H2(P) Houses)
H2(P)-SG-006	Office	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H2(P) Houses)
H2(P)-SG-007	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H2(P) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
H2(P)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H2(P) Houses)
H2(P)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H2(P) Houses)
H2(P)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H2(P) Houses)
H2(P)-EG-004	EnSuite	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H2(P) Houses)
H2(P)-EG-005	EnSuite	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H2(P) Houses)
H2(P)-EG-006	WC	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H2(P) Houses)
H2(P)-EG-007	Utility	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type H2(P) Houses)
House Type C3(P)									
C3(P)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C3(P) Houses)
C3(P)-SG-002	Master Bedroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C3(P) Houses)
C3(P)-SG-003	Bedroom 2	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C3(P) Houses)
C3(P)-SG-004	Bedroom 3	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C3(P) Houses)
C3(P)-SG-005	Bedroom 4	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C3(P) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
C3(P)-SG-006	Office	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C3(P) Houses)
C3(P)-SG-007	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C3(P) Houses)
C3(P)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C3(P) Houses)
C3(P)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C3(P) Houses)
C3(P)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C3(P) Houses)
C3(P)-EG-004	EnSuite	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C3(P) Houses)
C3(P)-EG-005	EnSuite	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C3(P) Houses)
C3(P)-EG-006	WC	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C3(P) Houses)
C3(P)-EG-007	Utility	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C3(P) Houses)
House Type C1(A)									
C1(A)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(A) Houses)
C1(A)-SG-002	Master Bedroom	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(A) Houses)
C1(A)-SG-003	Bedroom 2	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(A) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
C1(A)-SG-004	Bedroom 3	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(A) Houses)
C1(A)-SG-005	Study	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(A) Houses)
C1(A)-SG-006	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(A) Houses)
C1(A)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(A) Houses)
C1(A)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(A) Houses)
C1(A)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(A) Houses)
C1(A)-EG-004	WC	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(A) Houses)
C1(A)-EG-005	Store with WM	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type C1(A) Houses)
House Type J1(A)									
J1(A)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(A) Houses)
J1(A)-SG-002	Master Bedroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(A) Houses)
J1(A)-SG-003	Bedroom 2	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(A) Houses)
J1(A)-SG-004	Office	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(A) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
J1(A)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(A) Houses)
J1(A)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(A) Houses)
J1(A)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(A) Houses)
J1(A)-EG-004	Store with WM	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type J1(A) Houses)
House Type K1(P)									
K1(P)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K1(P) Houses)
K1(P)-SG-002	Master Bedroom	Circular	Powder	125Ø	24	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K1(P) Houses)
K1(P)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K1(P) Houses)
K1(P)-EG-002	Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K1(P) Houses)
K1(P)-EG-003	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K1(P) Houses)
K1(P)-EG-004	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K1(P) Houses)
House Type K2(P)									
K2(P)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K2(P) Houses)
K2(P)-SG-002	Master Bedroom	Circular	Powder	125Ø	24	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K2(P) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
K2(P)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K2(P) Houses)
K2(P)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K2(P) Houses)
K2(P)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K2(P) Houses)
K2(P)-EG-004	Store with WM	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type K2(P) Houses)
House Type B3(A)									
B3(A)-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(A) Houses)
B3(A)-SG-002	Master Bedroom	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(A) Houses)
B3(A)-SG-003	Bedroom 2	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(A) Houses)
B3(A)-SG-004	Bedroom 3	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(A) Houses)
B3(A)-SG-005	Office	Circular	Powder	125Ø	6	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(A) Houses)
B3(A)-SG-006	Dining	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(A) Houses)
B3(A)-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(A) Houses)
B3(A)-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(A) Houses)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
B3(A)-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(A) Houses)
B3(A)-EG-004	WC	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(A) Houses)
B3(A)-EG-005	Store with WM	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type B3(A) Houses)
Apartment Type 01									
T1-A1-SG-001	Living/Dining Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 01 Apartments)
T1-A1-SG-002	Master Bedroom	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 01 Apartments)
T1-A1-SG-003	Bedroom	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 01 Apartments)
T1-A1-SG-004	Office	Circular	Powder	125Ø	20	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 01 Apartments)
T1-A1-EG-001	M&E Store	Circular	Powder	125Ø	11	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 01 Apartments)
T1-A1-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 01 Apartments)
T1-A1-EG-003	Bathroom	Circular	Powder	125Ø	11	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 01 Apartments)
T1-A1-EG-004	Store with WM	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 01 Apartments)
Apartment Type 02									
T2-A1-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 02 Apartments)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
T2-A1-SG-002	Bedroom	Circular	Powder	125Ø	24	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 02 Apartments)
T2-A1-FAG-001	Bedroom	Circular	Powder	125Ø	16	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 02 Apartments with Bay Windows to mitigate Overheating Issue)
T2-A1-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 02 Apartments)
T2-A1-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 02 Apartments)
T2-A1-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 02 Apartments)
T2-A1-EG-004	Store with WM	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 02 Apartments)
Apartment Type 4A									
4A-A1-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 4A Apartments)
4A-A1-SG-002	Master Bedroom	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 4A Apartments)
4A-A1-SG-003	Bedroom 2	Circular	Powder	125Ø	5	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 4A Apartments)
4A-A1-SG-004	Office	Circular	Powder	125Ø	20	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 4A Apartments)
4A-A1-EG-001	M&E Store	Circular	Powder	125Ø	15	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 4A Apartments)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
4A-A1-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 4A Apartments)
4A-A1-EG-003	Bathroom	Circular	Powder	125Ø	15	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 4A Apartments)
Apartment Type 13									
13-A4-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 4A Apartments)
13-A4-SG-002	Master Bedroom	Circular	Powder	125Ø	24	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 4A Apartments)
13-A4-EG-001	M&E Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 4A Apartments)
13-A4-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 4A Apartments)
13-A4-EG-003	Bathroom	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 4A Apartments)
13-A4-EG-004	Store with WM	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 4A Apartments)
Apartment Type 15									
T15-A4-SG-001	Living Room	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 15 Apartments)
T15-A4-SG-002	Master Bedroom	Circular	Powder	125Ø	16	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 15 Apartments)
T15-A4-FAG-001	Master Bedroom	Circular	Powder	125Ø	24	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 15 Apartments with Bay Windows to mitigate Overheating Issue)

Ref	Service / Location	Type	Material/ Finish	Grille / diffuser size	Duty				Note
				Nominal size (mm)	Volume (l/s)	Max Pressure drop (Pa)	Throw (m)	Room Noise Rating (NR)	
T15-A4-EG-001	Store	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 15 Apartments)
T15-A4-EG-002	Kitchen	Circular	Powder	125Ø	13	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 15 Apartments)
T15-A4-EG-003	Shower Room	Circular	Powder	125Ø	8	15	N/A	Refer Note 09	Diffuser with Integral damper for Flow Control (Typical for Type 15 Apartments)

Notes

1. Selections based on Trox, equal and approved.
2. All supply diffusers to be complete with plenum boxes. Contractor shall ensure that plenum boxes / spigot sizes are selected to meet the air volume and room noise criteria. Maximum spigot velocity: 2.5m/s
3. Throw is based on a terminal velocity of 0.5m/s at 0.75 x the distance to a wall or the mid-point between 2 diffusers
4. Maximum mean air velocity in occupied zone: Cooling 0.19m/s; Heating 0.16m/s. to comply with category B thermal environment in accordance with BS EN ISO 7730
5. Unless noted otherwise, all grilles and diffusers shall be fitted with opposed blade dampers, this shall be fitted either to the grille or fitted to the plenum box spigot.
6. All grilles and diffusers shall be supported independently of the ceiling grid.
7. Finish: powder coat to an RAL colour as agreed with the architect.
8. Refer to architect's proposed ceiling details for fixing arrangement.
9. For final room noise rating, refer to the acoustic report.
10. Overall grille sizes to be consistent with layout grid ceiling.
11. All Air Valves for the Houses to be Fire Rated to match the fire rating of the ceiling.

Louvre Reference / Location	Service	Air volume (m^3/s)	Face Velocity m/s	Free Area (m^2)	Active Louvre Area @ 50% (m^2)	Size (mm)		Classification to BS EN 13030		Maximum pressure Drop (Pa)	Limiting Noise level (Sound power level dB(A))	Notes / Accessories
						Wdt	Ht	Water Penetration class	Limiting core velocity (m/s)			
House Type A1(P)												
A1(P)-FAL-001	Intake Air Louvre	0.045	3.00	0.015	0.030	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
A1(P)-EAL-001	Exhaust Air Louvre	0.045	3.00	0.015	0.030	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type K1(A)												
K1(A)-FAL-001	Intake Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required
K1(A)-EAL-001	Exhaust Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required
House Type A1(A)												
A1(P)-FAL-001	Intake Air Louvre	0.045	3.00	0.015	0.030	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
A1(P)-EAL-001	Exhaust Air Louvre	0.045	3.00	0.015	0.030	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type A2(A)												
A2(A)-FAL-001	Intake Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
A2(A)-EAL-001	Exhaust Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type A2(P)												
A2(P)-FAL-001	Intake Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
A2(P)-EAL-001	Exhaust Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type D1(A)												
D1(A)-FAL-001	Intake Air Louvre	0.057	3.00	0.019	0.038	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
D1(A)-EAL-001	Exhaust Air Louvre	0.057	3.00	0.019	0.038	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type B2(A)												
B2(A)-FAL-001	Intake Air Louvre	0.057	3.00	0.019	0.038	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
B2(A)-EAL-001	Exhaust Air Louvre	0.057	3.00	0.019	0.038	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl

Y46sch1 - Schedule of Louvres and air intake / discharge terminals

Louvre Reference / Location	Service	Air volume (m^3/s)	Face Velocity m/s	Free Area (m^2)	Active Louvre Area @ 50% (m^2)	Size (mm)		Classification to BS EN 13030		Maximum pressure Drop (Pa)	Limiting Noise level (Sound power level dB(A))	Notes / Accessories
						Wdt	Ht	Water Penetration class	Limiting core velocity (m/s)			
House Type F1(A)												
F1(A)-FAL-001	Intake Air Louvre	0.045	3.00	0.015	0.030	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
F1(A)-EAL-001	Exhaust Air Louvre	0.045	3.00	0.015	0.030	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type K2(A)												
K2(A)-FAL-001	Intake Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
K2(A)-EAL-001	Exhaust Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type J1(P)												
J1(P)-FAL-001	Intake Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
J1(P)-EAL-001	Exhaust Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type B2(P)												
B2(P)-FAL-001	Intake Air Louvre	0.057	3.00	0.019	0.038	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
B2(P)-EAL-001	Exhaust Air Louvre	0.057	3.00	0.019	0.038	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type D1(P)												
D1(P)-FAL-001	Intake Air Louvre	0.057	3.00	0.019	0.038	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
D1(P)-EAL-001	Exhaust Air Louvre	0.057	3.00	0.019	0.038	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type F1(P)												
F1(P)-FAL-001	Intake Air Louvre	0.053	3.00	0.018	0.036	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
F1(P)-EAL-001	Exhaust Air Louvre	0.053	3.00	0.018	0.036	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type B3(P)												
B3(P)-FAL-001	Intake Air Louvre	0.053	3.00	0.018	0.036	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
B3(P)-EAL-001	Exhaust Air Louvre	0.053	3.00	0.018	0.036	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type C1(P)												
C1(P)-FAL-001	Intake Air Louvre	0.053	3.00	0.018	0.036	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl

Louvre Reference / Location	Service	Air volume (m^3/s)	Face Velocity m/s	Free Area (m^2)	Active Louvre Area @ 50% (m^2)	Size (mm)		Classification to BS EN 13030		Maximum pressure Drop (Pa)	Limiting Noise level (Sound power level dB(A))	Notes / Accessories
						Wdt	Ht	Water Penetration class	Limiting core velocity (m/s)			
C1(P)-EAL-001	Exhaust Air Louvre	0.053	3.00	0.018	0.036	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type H1(P)												
H1(P)-FAL-001	Intake Air Louvre	0.061	3.00	0.020	0.040	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
H1(P)-EAL-001	Exhaust Air Louvre	0.061	3.00	0.020	0.040	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type H2(P)												
H2(P)-FAL-001	Intake Air Louvre	0.061	3.00	0.020	0.040	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
H2(P)-EAL-001	Exhaust Air Louvre	0.061	3.00	0.020	0.040	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type C3(P)												
C3(P)-FAL-001	Intake Air Louvre	0.061	3.00	0.020	0.040	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
C3(P)-EAL-001	Exhaust Air Louvre	0.061	3.00	0.020	0.040	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type J1(A)												
J1(A)-FAL-001	Intake Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
J1(A)-EAL-001	Exhaust Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type K1(P)												
K1(P)-FAL-001	Intake Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required
K1(P)-EAL-001	Exhaust Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required
House Type K2(P)												
K2(P)-FAL-001	Intake Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
K2(P)-EAL-001	Exhaust Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type B3(A)												
B3(A)-FAL-001	Intake Air Louvre	0.045	3.00	0.015	0.030	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl

Louvre Reference / Location	Service	Air volume (m^3/s)	Face Velocity m/s	Free Area (m^2)	Active Louvre Area @ 50% (m^2)	Size (mm)		Classification to BS EN 13030		Maximum pressure Drop (Pa)	Limiting Noise level (Sound power level dB(A))	Notes / Accessories
						Wdt	Ht	Water Penetration class	Limiting core velocity (m/s)			
B3(A)-EAL-001	Exhaust Air Louvre	0.045	3.00	0.015	0.030	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
House Type C1(A)												
C1(A)-FAL-001	Intake Air Louvre	0.045	3.00	0.015	0.030	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
C1(A)-EAL-001	Exhaust Air Louvre	0.045	3.00	0.015	0.030	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	To Terminate with Vent Cowl
Apartment Type 01												
T1-A1-FAL-001	Intake Air Louvre	0.043	3.00	0.014	0.028	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required
T1-A1-EAL-001	Exhaust Air Louvre	0.043	3.00	0.014	0.028	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required
Apartment Type 02												
T2-A1-FAL-001	Intake Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required
T2-A1-EAL-001	Exhaust Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required
Apartment Type 4A												
4A-A1-FAL-001	Intake Air Louvre	0.043	3.00	0.014	0.028	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required
4A-A1-EAL-001	Exhaust Air Louvre	0.043	3.00	0.014	0.028	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required
Apartment Type 13												
13-A4-FAL-001	Intake Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required
13-A4-EAL-001	Exhaust Air Louvre	0.037	3.00	0.012	0.024	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required
Apartment Type 15												
T15-A4-FAL-001	Intake Air Louvre	0.029	3.00	0.010	0.020	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required

Louvre Reference / Location	Service	Air volume (m^3/s)	Face Velocity m/s	Free Area (m^2)	Active Louvre Area @ 50% (m^2)	Size (mm)		Classification to BS EN 13030		Maximum pressure Drop (Pa)	Limiting Noise level (Sound power level dB(A))	Notes / Accessories
						Wdt	Ht	Water Penetration class	Limiting core velocity (m/s)			
T15-A4-EAL-001	Exhaust Air Louvre	0.029	3.00	0.010	0.020	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required
Water Plantroom, Block A3												
A3-FAL-00-001	Intake Air Louvre	0.150	3.00	0.050	0.100	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required
A3-EAL-00-001	Exhaust Air Louvre	0.150	3.00	0.050	0.100	By Architect		Refer to Architects Specification	2.5	See Note 10	N/A	Weatherproof, Bird/insect mesh required

Notes

1. All louvres are part of the Architects package. Purpose of schedule is to indicate the requirements needed for coordination purposes. Contractor is to ensure they liaise with the relevant trade contractor to ensure the air volume requirements are met and for integration of the plenum arrangement where required.
2. Louvres to be weather resistant to Architect's Specification with wire mesh screen to prevent ingress leaves and birds (tested in accordance with BS EN 13030) where indicated in the note's column.
3. Finish to be powder coated to RAL in accordance with architects' requirements.
4. All louvres (sizes, positions etc) are subject to final agreement with architect and co-ordination with steelwork as required.
5. All unused sections of louvre are to be blanked off by the supplier.
6. All louvres are to be agreed with the Architect prior to installation
7. All interfaces between M&E items such as where ducted connections are integrated with louvres supplied by others are to be fully co-ordinated between the contractors to provide a complete installation.
8. Air intake mesh will not be larger than 12.7mm
9. All insect / bird mesh etc is to be corrosion resistant.
10. Maximum pressure drops:

- *Supply:* Face Velocity: 1.0 m/s Pressure Drop: < 15 Pa
  Face Velocity: 1.8 m/s Pressure Drop: 25 Pa
- *Extract:* Face Velocity: 1.8 m/s Pressure Drop: 25 Pa
  Face Velocity: 3.0 m/s Pressure Drop: 45 Pa
  Face Velocity: 4.0 m/s Pressure Drop: 75 Pa

Pressure drops to include bird mesh and insect screen

11. Active louvre area is based on the assumption of 50% free area being provided and is provided to give an indication of the size of louvre required. Final size is subject to selected supplier and the specification by architect, and the discharge coefficients achieved to meet the indicated pressure drops.
12. All Cycle/Bike Store's to be naturally ventilated via Louvres.

Service	Location	Material	Applied Finish	Function (N, F or C)	Notes
LPHW HWS HWS storage vessels Heat exchangers and other pipeline mounted components	In plant areas	Rock or Glass Mineral wool or CFC and HCFC free phenolic foam	Hammerclad Aluminium or sheet steel coated with aluminium / zinc alloy. Aluminium Clad to 2mtr in height from FFL.	N	Insulation shall be carried through the pipeline supports including all off-site prefabricated pipework / modules. For temperature maintenance of HWS pipework with trace heating the insulation thickness shall be agreed with the trace heating specialist to suit the tape selected. Phenolic foam sections shall have a suitable dust suppressant, acid neutralising and passivating internal coating. All exposed edges of phenolic foam insulation shall be sealed to the surface being insulated with a suitable vapour sealing mastic
	Internally in voids and ducts		Class O Aluminium foil	N	
	Internally where visible other than plant areas (exposed).		Class O Aluminium foil	N	
	Externally		laminated foil/film protection (eg Venturclad - can either factory pre-applied or applied in-situ)	N	
CWS Condensate Drains Internal Rainwater	In plant areas	Rock or Glass Mineral wool or CFC and HCFC free phenolic foam	Hammerclad Aluminium or sheet steel coated with aluminium / zinc alloy	N / C	Vapour seal required in all locations, including supports Phenolic foam sections shall have a suitable dust suppressant, acid neutralising and passivating internal coating. All exposed edges of phenolic foam insulation shall be sealed to the surface being insulated with a suitable vapour sealing mastic
	Internally in voids and ducts		Class O Aluminium foil		
	Internally where visible other than plant areas (exposed)		Class O Aluminium foil		
	Externally		laminated foil/film protection (e.g. Ventureclad – can be either factory pre-applied or applied in-situ)		
	Internally in voids and ducts		Class O Aluminium foil on each layer of insulation		
	Internally where visible other than plant areas (exposed)		Class O Aluminium foi lon each layer of insulation		

Service	Location	Material	Applied Finish	Function (N, F or C)	Notes
HTHW MTHW Steam and condense	In plant areas	Rock or Glass Mineral wool	Hammerclad Aluminium or sheet steel coated with aluminium / zinc alloy. Aluminium Clad to 2mtr in height from FFL.	N	All discharge lines from safety valves shall be insulated in all areas including externally where there is a possibility of injury to maintenance personnel. Insulation shall be carried through the pipeline supports including all off-site prefabricated pipework / modules.
	Internally in voids and ducts		Class O Aluminium foil,	N	
	Internally where visible other than plant areas (exposed)		Class O Aluminium foil.	N	
	Externally		laminated foil/film protection (see guidance notes Ref comparison with PIB)	N	
Water Tanks	Internally	Rock or Glass Mineral wool or CFC and HCFC free phenolic foam in slab form	Hammerclad Aluminium or sheet steel coated with aluminium / zinc alloy	F/C	
	Externally		laminated foil/film protection		Ensure all joints are weatherproofed Tanks externally to be painted white or other highly reflective colour in order to minimise heat gain.
Service	**Location**	**Material**	**Applied Finish**	**Function (N, F or C)**	**Notes**

LTHW	In plant areas	CFC and HCFC free phenolic foam, with thermal conductivity of no greater than 0.025W/mK at a mean temperature of 10°C when fully aged in accordance with BE EN 14314, on all pipework in the heat network including pipework upto HIU within dwelling	Hammerclad Aluminium or sheet steel coated with aluminium / zinc alloy	N	Insulation shall be carried through the pipeline supports including all off-site prefabricated pipework / modules. Insulation within support to be of same thickness and material as of main pipework. Phenolic foam sections shall have a suitable dust suppressant, acid neutralising and passivating internal coating. All exposed edges of phenolic foam insulation shall be sealed to the surface being insulated with a suitable vapour sealing mastic. All heating pipework and associated ancillaries within the network is to be insulated of the same specification. Insulation thickness to be minimum 75mm within the riser and Corridors. Pipe Insulation may reduce locally while connecting to HIU within Utility Cupboard due to the limitation of unit to accommodate 75mm thick insulation. Hence, only for branch connection to HIU within the apartments, the insulation drops to 50mm.However, length of the pipework with reduced insulation to be minimized to as low as possible.
	Internally in voids and ducts		Class O Aluminium foil	N	
	Internally where visible other than plant areas (exposed).		Class O Aluminium foil	N	

Service	**Location**	**Material**	**Applied Finish**	**Function (N, F or C)**	**Notes**

Supply ductwork (including inlet D/W to AHU or fan) Extract ductwork downstream of reclaim coils	In plant areas	On rectangular ducts use Rock or Glass Mineral wool or CFC and HCFC free phenolic foam slabs. On circular or flat oval use Mineral fibre lamella mat or crimped mat.	Hammerclad Aluminium or sheet steel coated with aluminium / zinc alloy	N (N/C on cooled ducts)	Insulation on supply ductwork carrying chilled air to incorporate continuous vapour seal
Supply ductwork (including inlet D/W to AHU or fan) and duct mounted components. Extract ductwork before a heat recovery device	Internally in voids and ducts and where visible when the duct surface temperature is below the dew point of the space served.	On rectangular ducts use Rock or Glass Mineral wool rigid insulation or CFC and HCFC free phenolic foam slabs. On circular or flat oval use Mineral fibre lamella mat or crimped mat	In voids & ducts - Class O Aluminium foil. Visible ductwork to be clad with stainless steel sheet or RAL colour coated steel or aluminium sheet.	N (N/C on cooled ducts)	Insulation on supply ductwork carrying chilled air to incorporate continuous vapour seal. Extent of insulation to include ductwork downstream of fan coil and VAV / CV terminal units including terminal plenum boxes
	Internally where visible other than plant areas (exposed) carrying air above 20°C	N/A	N/A		
	Externally	On rectangular ducts use Rock or Glass Mineral wool duct slab or CFC and HCFC free phenolic foam slabs or sections. On circular or flat oval use Mineral fibre lamella mat or crimped mat	Laminated foil/film protection either factory pre-applied or applied in-situ)	N (N/C on cooled ducts)	Insulation on supply ductwork carrying chilled air to incorporate continuous vapour seal
Untreated Outside Air ductwork	Internally	As supply	As supply	C	
Extract ductwork	Externally before a Heat recovery device Hot air exhaust ductwork where the ductwork could radiate heat back to the room (e.g. extract from UPS)	As supply	Laminated foil/film protection either factory pre-applied or applied in-situ)	C	
	Elsewhere	N/A			
Service	**Location**	**Material**	**Applied Finish**	**Function (N, F or C)**	**Notes**

Fresh & Exhaust Ductwork (MVHR)	Internally after a Heat recovery device	As supply	In voids & ducts - Class O Aluminium foil. Visible ductwork to be clad with stainless steel sheet or RAL colour coated steel or aluminium sheet.	N (N/C on cooled ducts)	Insulation on fresh and exhaust ductwork carrying air to incorporate continuous vapour seal. Insulation thickness to be minimum 25mm.

Functions:

N Normal: The control of heat loss and gain
F The prevention of freezing
C The prevention of surface condensation

Notes.

1. Selections based on Kingspan, or equal and approved.
2. Insulation of Pipework to be as per the Basis of Design.
3. Refer to Workmanship Specification Section Y50 for appropriate thickness of insulation to suit specified function.
4. Refer to clause Y50 2221 for valves, ancillaries, and flange insulation requirements
5. In locations where insulation cannot be installed adequately after pipeline or ductline installation, pre-insulated sections shall be installed. Insulation to such sections shall be equivalent in thermal and physical properties to that specified for the remainder of the system including vapour barriers.
6. Contractors to demonstrate that all elements of the heat network have been insulated, particularly for those sections of network that will be inaccessible after construction.
7. Pipes to be concealed behind drylining are to be witnessed by Wates for insulation. In the case where this is not possible, photos of all sections of pipework should be taken, with locations clearly defined.

Ref	Plant Description & Location	Flexible Connections reqd. (Yes or No) (see Y11 for Spec)	Housekeeping Plinth only	Inertia Base (Yes or No)	Other Mounting		Approx Plant weight Kg	clause ref in specification ref Y52
					Type	Static Deflection (mm)		
	All pumps	Yes	Yes	Yes	Sprung inertia bases or frames Mat & pad	6mm	TBC by manufacturer	Mat & pad mountings should only be considered in basement areas
	Suspended Fans & Ductwork	Yes	No	No	Spring compression	12mm	TBC by contractors	
	Equipment Duct Connections	Yes	No	No	-	-	TBC by contractors	Provide flexible ductwork and plant connections as indicated in Y30 Air Ductlines
	Suspended Pipelines	Yes	No	No	Spring compression hangers	12mm	TBC by contractors	
	Floor Mounted Pipelines	Yes	No	No	Spring compression hangers suspended from 'goalposts'	12mm	TBC by contractors	
	Inertia Bases	Yes	-	-	Spring compression mounting	12mm	TBC by contractors	
	Pipe, Wall & Riser Seals	-	-	-	-	-	TBC by contractors	Applies to all pipelines and ductlines for all services penetrating plant room and other similar enclosures

Notes

1. Approx. plant weight is for tender purposes only; the contractor shall confirm plant weight to supplier of mountings before ordering.
2. All packaged plant shall be provided with integral means of vibration isolation to prevent noise and vibration transmission to the structure. Units to be mounted on pads between plant and structure.
3. All pipework within plant areas shall be supported on spring hangers.
4. All plant shall have a housekeeping plinth unless stated otherwise.

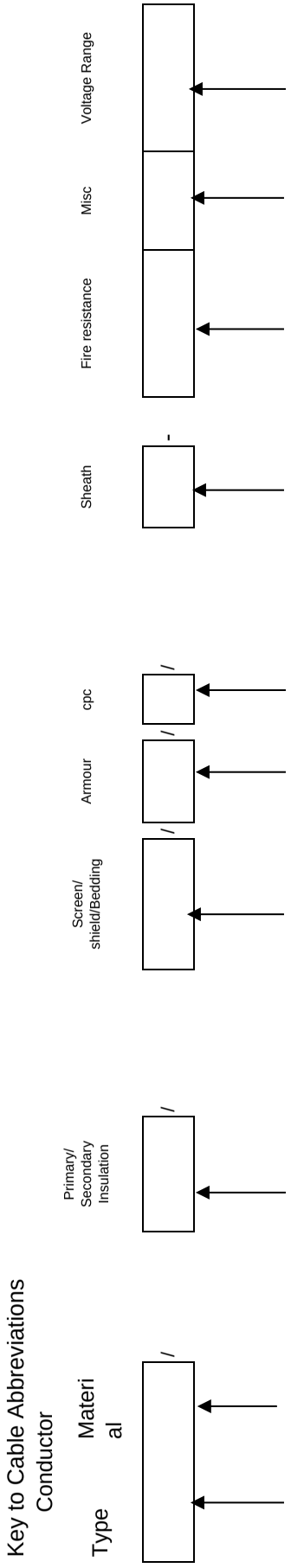
Application	Conduit Type/Finish	Standard	Saddles	Fittings	Locknuts	Plugs	Notes
Internal areas except plantrooms	Rigid steel seam welded heavy gauge. Black enamel Class 2.	BS EN 61386 parts - 1 & 21	Plain	Malleable Iron	Steel	Hex Brass	
Plant rooms and external areas	Rigid steel seam welded heavy gauge. Hot dipped galvanised Class 4	BS EN 61386 parts - 1 & 21	Plain	Malleable Iron	Malleable Iron	Hex Brass	
Connections to motors and for expansion joints	Flexible steel	BS EN 61386 parts - 1 & 21	-	Malleable Iron	Steel	Hex Brass	
Corrosive atmosphere high humidity areas eg. Swimming pools	Rigid non-metallic PVC	BS 4607 Part 1 and BS EN 61386-1	PVC	PVC Solvent welded	PVC	Spout entry	
Expansion joints and where otherwise PVC appropriate	Flexible non-metallic PVC	BS 4607 Part 1 and BS EN 61386-1	-	PVC	PVC Screwed ring	Spout entry	
Cable Management Systems (Internal areas)	Rigid steel	BS EN 61386-21	Plain	Malleable Iron	Steel	Hex Brass	
	Rigid non-metallic	BS 4607 Part 1 or BS EN 61386-21	PVC	PVC Solvent welded	PVC	Spout entry	
	Pliable	BS EN 61386-22	-				
	Flexible	BS EN 61386-23	-				

'Standard' Trunkings						
Application	**Trunking Type/Finish**	**Colour**	**Standard**	**Compartment**	**Size**	**Notes**
Internal areas	Steel – hot dipped galvanised finish class 3	Self Colour	Relevant parts of BS EN 50085			
External areas	Steel – hot dipped galvanised finish class 3	Self Colour	Relevant parts of BS EN 50085			Lids to be flanged and gasketted.
Areas with corrosive atmospheres and/or high humidities	Non Metallic PVC heavy gauge	Manufacturers standard	Relevant parts of BS EN 50085			
Wall/Dado Trunking	Marshall Tufflex Sterling 1,2 or 3 range					

Application			Description	Abbreviation	Standard	Max Temp.	Conductor	Voltage Range	Fire Classification	Notes
Final connection to luminaires and other small loads.			Single and multi-core rubber insulated and HFOR sheathed flexible cord.	FStr/EPR/HFOR	relevant part of BS EN 50525	60°C	Flexible	300/500V	see guidance	Where prone to physical damage enclose in flexible conduit
			Multi-core, flexible stranded conductor, 90°C thermoplastic insulated with 90°C thermoplastic sheath.	FStr/HTPVC/HTPVC		90°C	Flexible	300/500V		
			Circular twin, three, four or five core, LSOH insulated cables with LSOH sheath, with stranded conductors.	FStr/LSOH/LSOH – (05)	BS 7211 Table 6		Flexible	300/500V		
Ordinary duty, high temperature conditions.			Rubber insulated HOFR sheathed flexible cord.	FStr/EPR/HOFR	relevant part of BS EN 50525	90°C	Flexible	300/500V		Final connections to water heaters not subject to movement / vibration etc.
Heavy duty, high temperature conditions, final connections to plant and mechanical equipment. For final connections where BE2 condition exist.			Single and multi-core rubber insulated and sheathed flexible cord.	FStr/EPR/HFOR	relevant part of BS EN 50525 / BS 6004	90°C	Flexible	300/500V		Final connections to equipment subject to movement / vibration etc.
Switchgear and motor control panel wiring			Thermoplastic insulated flexible stranded cable	FStr/HTPVC	BS 6231 Type CK	90°C	Flexible	600/1000V		
Power supplies to life safety, fire-fighting and other critical applications (refer to BS 8519) and associated controls.	BS 8519 Cable Category	1	Multicore, stranded conductors with mica glass primary insulation and XLPE secondary insulation, LS0H extruded bedding, steel tape armour and LS0H oversheath. Fire resistant to BS 8419 to provide 30, 60 or 120 minutes survival.	Mi-XLPE/LS0H/St TAPE/LS0H – FR30	BS 7846 BS 8491	90°C	Stranded Copper	450/750V		Power cables of overall diameter less than 20 mm may be used if they can be demonstrated to give the same level of fire resistance as in BS 8491, which identifies test criteria for cables over 20 mm overall in diameter.
		2		Mi-XLPE/LS0H/St TAPE/LS0H – FR60						
		3		Mi-XLPE/LS0H/St TAPE/LS0H – FR120						
Fire detection and protection circuits, EVC circuits, evacuation alert system circuits, emergency lighting circuits and controls cables of life safety, fire fighting and other critical applications (refer to BS 8519), excluding 3 phase power circuits	BS 8519 Cable Category	1	'Soft skinned' Multicore, solid or stranded conductors with Silicon insulation, tinned cpc and copper tape screen and LS0H sheath. Fire rated to BS EN 50200 PH30 in addition the cables should meet the 30 min survival time when tested in accordance with BS EN 50200 Annex E. (BS 5839-1 'standard' fire resisting cables)	Si/E/CuTape/LS0H-FR30	BS 7629	90°C	Copper	300/500 V		To be provided with mechanical protection where cables are run in areas prone to mechanical damage or run below 2.1m AFFL. Where a Category 3 control cable is used as a single-phase small power cable, then a mechanically-protected (e.g. armoured) cable should be used or additional mechanical protection should be provided.
		3	'Soft skinned' Multicore, solid or stranded conductors with Silicon insulation, tinned cpc and copper tape screen and LS0H sheath. Fire rated to BS EN 50200 PH120 in addition the cables should meet the 120 min survival time when tested in accordance with BS 8434-2 and BS 8519 Annex D. (BS 5839-1 'enhanced' fire resisting cables)	Si/E/CuTape/LS0H-FR120				600/1000V		
Fire detection and protection circuits, EVC circuits, evacuation alert system circuits, emergency lighting circuits and controls / single phase power circuits of life safety, fire fighting and other critical applications (refer to BS 8519) with LS0H application	BS 8519 Cable Category	1 to 3	Light Duty Single or Multicore mineral insulated, copper covered, LSOH sheath.	MICC/LS0H - (05)	BS EN 60702-1 Section 14	-	Solid Copper	500V		

Application		Description	Abbreviation	Standard	Max Temp.	Conductor	Voltage Range	Fire Classification	Notes
Three phase power supplies of life safety, fire-fighting and other critical applications (refer to BS 8519) with LS0H application	BS 8519 Cable Category 1 to 3	Heavy duty Single or Multicore mineral insulated copper covered LS0H sheath	MICC/LS0H	BS EN 60702-1 Section 15	-	Solid Copper	750V		
Instrumentation		Thermoplastic insulated multicore or multipair with or without screens, Thermoplastic sheath with or without steel wire armour	PVC/PVC PVC/SWA/PVC	BS EN 50288-7	-	Copper	300/500V		For control, indication, alarm functions associated with switchgear and power apparatus
Instrumentation		Polyethylene insulated multicore or multipair with or without screens, Thermoplastic sheath with or without steel wire armour	PVC/PVC PVC/SWA/PVC	BS EN 50288-7	-	Copper	450/750V		For speech and data transmission. Also feeder protection circuits in excess of one kilometre
Power and lighting installation in conduit/trunking with LS0H application		Single core LSOH insulated cables (non-armoured), with stranded conductors.	LS0H	BS 7211 Table 5	90°C	Stranded Copper	300/500V		
		Single core Pre-Engineered Wiring System with single core LS0H insulated cables with LS0H Sheath	LS0H/LS0H - PWS		90°C				
		Single core Pre-Engineered Wiring System with single core LS0H insulated cables with flexible metallic sheath.	LS0H/FM - PWS		90°C				
Power and lighting installation within voids with LS0H application		Flat, twin or three core, LSOH insulated cables with bare cpc conductor and LSOH sheath, with stranded conductors.	LS0H/E/LS0H – (05)	BS 7211 Table 7	90°C	Stranded Copper	300/500V		Only to be used where specifically specified
Power and lighting installation within building voids and thin partitions, with LS0H application		Multicore XLPE insulated cables with integral cpc, and bonded screened LSOH oversheath.	XLPE/E/Screen/LSOH – (05)	BS 8436	90°C	Solid Copper	300/500V		Only to be protected by Type B
Power and lighting SP, TP, TPN in conduit/trunking with LS0H application		Single or Multicore XLPE insulated un-armoured, LS0H sheath.	LS0H/LS0H – (05)	BS 7211 Table 6	90°C	Stranded Copper	450/750V		Only to be used where specifically specified
LV Power distribution SP, TP or TPN on tray, rack or in trenches with LS0H application		Single or Multicore XLPE insulated armoured LS0H sheathed. Aluminium wire for SC cables.	XLPE/LS0H/AWA/LS0H XLPE/LS0H/SWA/LS0H	BS 6724 Tables 4, 6, 8 & 10	90°C	Stranded Copper	600/1000V		
HV Power distribution on tray, rack or in trenches with LS0H application		Single or multicore, XLPE insulated, copper tape screen, thermoplastic bedding, steel or aluminium wire armoured and LSOH oversheath, , with stranded conductors, 6350/11000V Grade.	XLPE/CuTape/XLPE/ AWA/LSOH - (11) or XLPE/CuTAPE/XLPE/ SWA/LSOH – (11)	Otherwise as BS 6622/ EC502	90°C	Stranded Copper	3.8/6.6kV 6.35/11kV 8.7/15kV 12.7/22kV 19/33kV		
Signs and discharge tube installations		Single core, silicone rubber insulated, screened with LS0H sheath.	SIL/Cu BRAID/LS0H–(5)	BS EN 50143 Type D2	90°C		5/10kV		
Power and lighting installation in conduit/trunking		Single core Thermoplastic insulated un-armoured	PVC	BS 6004 Table 4b	70°C	Stranded Copper	300/500V		
		Single core heat resisting rubber insulated	EPR (HO7G-K)	relevant part of BS EN 50525	110°C	Stranded Copper (Flexible Class 5)	450/750V		
Power and lighting installation within voids.		Single core, flat twin and 3 core, thermoplastic insulated and sheathed, non-armoured cables, with stranded conductors.	PVC/PVC	BS 6004 Table 7	70°C	Stranded Copper	300/500V		Only to be used where specifically specified
		Single core, flat twin and three core thermoplastic insulated and sheathed with bare cpc and stranded conductors.	PVC/E/PVC	BS 6004 Table 8	70°C	Stranded Copper	300/500V		Only to be used where specifically specified

Application	Description	Abbreviation	Standard	Max Temp.	Conductor	Voltage Range	Fire Classification	Notes
LV Power distribution SP, TP, or TPN on tray	Single or Multicore XLPE insulated un-armoured, Thermoplastic sheath	XLPE/PVC	BS 5467 Tables 4, 6, 8 & 10.	90°C	Stranded Copper	600/1000V		
LV Power distribution SP, TP or TPN on tray, rack or in trenches	Single or Multicore XLPE insulated armoured, Thermoplastic sheathed. Aluminium wire for S.C. cables.	XLPE/SWA/PVC XLPE/AWA/PVC	BS 5467	90°C	Stranded Copper	600/1000V		
HV Power distribution on tray or rack	Single or Multicore XLPE insulated armoured, Thermoplastic sheathed. Aluminium wire for S.C. cables.	XLPE/SWA/PVC XLPE/AWA/PVC	BS 5467 Tables 14 & 16	90°C	Stranded Copper	1,900 / 3,300V		
HV Power distribution on tray, rack or in trenches	Single or multicore, XLPE insulated, copper tape screen, thermoplastic bedding, steel or aluminium wire armoured and a thermoplastic(PVC) oversheath, , with stranded conductors, 6350/11000V Gradesheath. Aluminium wire for SC cables.	XLPE/CuTapePVC/AWA/PVC - (11) Or XLPE/CuTape/PVC/ SWA/PVC – (11)	BS 6622/ EC502	70°C	Stranded Copper	3.8/6.6kV 6.35/11kV 8.7/15kV 12.7/22kV 19/33kV		
Power supplies to life safety and smoke control systems, fire detection and protection circuits, emergency lighting circuits and controls circuits of life safety and smoke control systems.	Light Duty Single or Multicore mineral insulated, copper covered, Thermoplastic sheath.	MICC/PVC – (05)	BS EN 60702-1 Section 14	-	Solid Copper	500V		
	Heavy duty Single or Multicore mineral insulated copper covered Thermoplastic sheath	MICC/PVC	BS EN 60702-1 Section 15	-	Solid Copper	750V		
Portable earthing and short circuiting equipment			BS EN 61138					
Signs and discharge tube installations	Single core, silicone rubber insulated, screened with Thermoplastic sheath.	SIL/Cu BRAID/PVC–(5)	BS EN 50143 Type D1	90°C		5/10kV		



0V	03
300/500V	05
450/750V	07
600/1,000V	10
3,800/6,600V	6.6

Pre-Engineered Wiring System	PWS

BS EN 50200 PH120 (i.e. BS 5839-1 ' enhanced' fire resisting cables)	PH120
BS EN 50200 PH30 (i.e. BS 5839-1 ' standard' fire resisting	PH30
BS 6387 Category CWZ	CWZ

Heat resisting (90°C)	HTPVC
Thermoplastic	PVC
Cross linked Polyethylene	XLPE
Flexible Metallic Metall	FM
Low smoke Zero halogen	LSOH
Chlorosulphonated polyethylene	CSP
Copper	Cu

Un-insulated core of cable	CPC

Aluminium wire	AWA
Steel tape	St TAPE
Steel wire	SWA

Ethylene propylene rubber	EPR
Silicon rubber	SIL
Low smoke Zero halogen	LSOH
Cross linked Polyethylene	XLPE
Heat resisting (90°C)	HTPVC
Ethylene propylene rubber	EPR
Theromoplastic	PVC
Copper tape	Cu TAPE
Copper braid	Cu BRAID

Ethylene propylene rubber	EPR
Paper	PI
Silicon rubber	SIL
Mica/Glass	Mi
Mineral	MI
Low smoke Zero halogen	LSOH
Cross linked Polyethylene	XLPE
Heat resisting (90°C)	HTPVC
Ethylene propylene rubber	EPR
Theromoplastic	PVC

Aluminium	Al
Copper	C

Highly Flexible	HStr
Flexible stranded (class 5)	FStr
Stranded (rigid)	Str
Solid (rigid round)	S

Notes

1. Refer to clause Y61.1011 for minimum fire classification for cables as required by BS 7671 (IET Wiring Regulations) and BS 6701.
2.

Cable Ref.	Cable Route		Phase and Neutral Conductors				Circuit Protective Conductor				Inst'n Details		Grouping		Fire Classification	Comments
	From	To	No of Cables in parallel	No of Conductors	csa (mm^2)	Cable Type	No of cables in parallel	No of Conductors	csa (mm^2)	Cable Type	Install' No.(1)	Method(1)	No of Circuits	Touching		
SMDB-A3-02	HDCO-1	SMDB-LL-A3-00	1	4c	95	XLPE/SWA/LS0H	1	1c	50	LS0H	20	C	1	✓	NA	
SMDB-A3-02	HDCO-2	SMDB-TT-A3-00	1	4c	70	XLPE/SWA/LS0H	1	1c	35	LS0H	20	C	1	✓	NA	
LL-A3-01	SMDB-LL-A3-00	DB-LL-01	1	4c	16	XLPE/SWA/LS0H	1	1c	16	LS0H	31	E	3	✓	NA	
LL-A3-02	SMDB-LL-A3-00	A3-ATS-03-01	1	4c	10	XLPE/SWA/LS0H	1	1c	10	LS0H	31	E	3	✓	FP600S	
A3-ATS-03	A3-ATS-03-01	LIFT CORE	1	4c	10	XLPE/SWA/LS0H	1	1c	10	LS0H	31	E	3	✓	FP600S	
LL-A3-04	SMDB-LL-A3-00	EXTERNAL DB	1	4c	16	XLPE/SWA/LS0H	1	1c	16	LS0H	31	E	3	✓	NA	
LL-A3-05	SMDB-LL-A3-00	GROUND FLOOR DB	1	4c	16	XLPE/SWA/LS0H	1	1c	16	LS0H	31	E	3	✓	NA	
LL-A3-07	SMDB-LL-A3-00	MCC-BCWS	1	4c	10	XLPE/SWA/LS0H	1	1c	10	LS0H	31	E	3	✓	NA	
LL-A3-08	SMDB-LL-A3-00	UPS-A3	1	4c	70	XLPE/SWA/LS0H	1	1c	35	LS0H	31	E	3	✓	FP600S	
LL-A3-09	SMDB-LL-A3-00	ATS-SPRINKLLER	1	4c	25	XLPE/SWA/LS0H	1	1c	16	LS0H	31	E	3	✓	FP600S	
ATS-SPRINKLLER/01	ATS-SPRINKLLER	ATS-SPRINKLLER/01	1	4c	25	XLPE/SWA/LS0H	1	1c	16	LS0H	31	E	3	✓	FP600S	
UPS CABLE FROM A3	UPS-A3	LSP A3	1	4c	70	XLPE/SWA/LS0H	1	1c	35	LS0H	31	E	3	✓	FP600S	

Cable Ref.	Cable Route		Phase and Neutral Conductors				Circuit Protective Conductor				Inst'n Details		Grouping		Fire Classification	Comments
	From	To	No of Cables in parallel	No of Conductors	csa (mm^2)	Cable Type	No of cables in parallel	No of Conductors	csa (mm^2)	Cable Type	Install' No.(1)	Method(1)	No of Circuits	Touching		
LSPA3/01	LSP A3	BLOCK A3 EVAC LIFT	1	4c	16	XLPE/SWA/LS0H	1	1c	16	LS0H	31	E	3	✓	FP600S	
LSPA3/02	LSP A3	BLOCK A4 EVAC LIFT	1	4c	25	XLPE/SWA/LS0H	1	1c	16	LS0H	31	E	3	✓	FP600S	
LSPA3/03	LSP A3	BLOCK A1 EVAC LIFT	1	4c	25	XLPE/SWA/LS0H	1	1c	16	LS0H	31	E	3	✓	FP600S	
LSPA3/05	LSP A3	BLOCK B EVAC LIFT	1	4c	25	XLPE/SWA/LS0H	1	1c	16	LS0H	31	E	3	✓	FP600S	
LSPA3/06	LSP A3	OUTDOOR UNIT DUTY (WATER PLANT ROOM)	1	2c	6	XLPE/SWA/LS0H	1	1c	6	LS0H	31	E	3	✓	FP600S	
LSPA3/07	LSP A3	OUTDOOR UNIT STANDBY (WATER PLANT ROOM)	1	2c	6	XLPE/SWA/LS0H	1	1c	6	LS0H	31	E	3	✓	FP600S	
LSPA3/04	LSP A3	BLOCK A3 SPRINKLER PUMP SET	1	4c	25	XLPE/SWA/LS0H	1	1c	16	LS0H	31	E	3	✓	FP600S	
UPS CABLE FROM A3	UPS - D	LSP-D	1	4c	35	XLPE/SWA/LS0H	1	1c	25	LS0H	31	E	3	✓	FP600S	
LSPD/01	LSP D	BLOCK C EVAC LIFT	1	4c	16	XLPE/SWA/LS0H	1	1c	16	LS0H	31	E	3	✓	FP600S	
LSPD/02	LSP D	BLOCK D EVAC LIFT	1	4c	10	XLPE/SWA/LS0H	1	1c	10	LS0H	31	E	3	✓	FP600S	
LSPD/03	LSP D	BLOCK E EVAC LIFT	1	4c	16	XLPE/SWA/LS0H	1	1c	16	LS0H	31	E	3	✓	FP600S	
LSPD/04	LSP D	BLOCK F EVAC LIFT	1	4c	25	XLPE/SWA/LS0H	1	1c	16	LS0H	31	E	3	✓	FP600S	

Cable Ref.	Cable Route		Phase and Neutral Conductors				Circuit Protective Conductor				Inst'n Details		Grouping		Fire Classification	Comments
	From	To	No of Cables in parallel	No of Conductors	csa (mm^2)	Cable Type	No of cables in parallel	No of Conductors	csa (mm^2)	Cable Type	Install' No.(1)	Method(1)	No of Circuits	Touching		

Notes:

1. Installation Methods and Numbers are 'worst' case conditions and relate to those detailed in Table 4A2 of BS 7671.
2. Cables are to be run in 'defined' conditions (spaced by 2 x D_e), unless the Group No of Circuits>1.
3. Where cables are 'grouped' they shall be run spaced by one cable diameter (D_e), unless identified as touching.
4. Single core cables are to be run in 'tre-foil' unless indicated otherwise.
5. For details of cable types refer to Schedule Y61sch1.

Minimum fire classification requirements of BS 7671

• All cables should meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating

• Cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, should meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}

• Cables encroaching on or run in escape routes should meet at least either BS EN 13501-6 EuroClass Dca-s2, or the relevant part of BS EN 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2

NOTE - See the following for further information BCA Guidance to Specifiers for the Construction Products Regulation (CPR) and cables, Edition 2

Cables within the scope of BS 6701

• All cables should meet or exceed BS EN 13501-6 EuroClass E_{ca}, or the requirements of BS EN 60332-1-2

• Cables intended for installation into pathways that are hidden below floors, behind walls, or to which access is limited, should meet or exceed BS EN 13501-6 EuroClass C_{ca}-s1b,d2,a2

Application	Support System	Side wall	Finish	Notes
Power Cables 50mm^2 and above	Rack (Ladder)	Sidewall to suit load and span, 100mm minimum	Hot dipped galvanised	
Cables over 30mm OD	Cable Tray : Heavy duty return flange	50mm Flange	Hot dipped galvanised / Epoxy powder coated	
Cables up to 30mm OD	Cable Tray : Medium duty tray return flange	25mm Flange	Hot dipped galvanised / Epoxy powder coated	
Cables over 30mm OD	Cable Basket : Heavy duty	5mm Rod 50mm Mesh 75mm Wall (minimum)	Zinc Plated	
Cables up to 30mm OD	Cable Basket : Medium duty	4mm Rod 50mm Mesh 50mm Wall (minimum)	Zinc Plated	
Communications	Cable Basket : Medium duty	4mm Rod 50mm Mesh 50mm Wall (minimum)	Zinc Plated	
Communications Underfloor	Cable Basket : Heavy duty	5mm Rod 50mm Mesh 75mm Wall (minimum)	Zinc Plated	

Notes:

1. Rack/Tray/Basket support system to be designed and installed in accordance with manufacturers recommendations for the imposed loadings and deflection. System to be consistent throughout unless specified otherwise.

Ref	Function	Construction	Form	IP	Circuit Arrangement	Fixed/Withdraw	Access	Cabling		Finish	Notes
								Power	Auxil		
SMDB-LL-A1-00	GROUND FLOOR ELECTRICAL SWITCH ROOM	INDOOR – MULTI CUBICLE	4b	31	SEE DIAGRAM 60663039-ACM-ZZ-ZZ-DR-EL-401001	FIXED	FRONT ONLY	INCOMER DOWN OUTGOING UP	UP	STANDARD	
SMDB-TT-A1-00	GROUND FLOOR ELECTRICAL SWITCH ROOM	INDOOR – MULTI CUBICLE	4b	31	SEE DIAGRAM 60663039-ACM-ZZ-ZZ-DR-EL-401001	FIXED	FRONT ONLY	INCOMER UP OUTGOING DOWN	UP	STANDARD	

Notes
1. Dark Grey BS381C Colour 632 Gloss
2. Where Front access only specified, this includes lifetime maintenance

Function	Type	Fixed or Withdraw	Poles	Mechanism	Close Volts	Open Volts	Protection Devices	Accessories	Notes
SMDB-LL-A1-00	Switch Disconnector	Fixed	Refer to Schematic	Motor Spring	230ac	30dc	O/C REF	1, 2, 3, 5, 8, 9, 11, 12	All relays shall be capable of adjusting the overlaod setting ot a minum range of 40%-100% of the nominal rating Protection Relay to shall be: (400A or higher)@ Schneider Electric Micrologic 5.3 or approved equivalent. (100A, 160A, 250A): Schneider Electric Micrologic 5.2 or approved equivalent.
SMDB-TT-A1-00	Switch Disconnector	Fixed	Refer to Schematic	Manual Spring	-	30dc	O/C (LSI)		

Accessories							
1	Ammeter	6	Operation Counter	11	Local Control	16	Special Warning Labels Y82.2011
2	Voltmeter	7	Anti-pump circuit	12	Local/Remote Select		
3	Wattmeter	8	Open/Close Lamps	13	Intertrip Send		
4	Power Factor Indicator	9	Fault-Trip lamp	14	Intertrip Receive		
5	Kilowatt hour meter	10	Trip Circuit Supervision	15	Additional VF Contacts		
					---NO ---NC		

Y71sch6 – Schedule of Fuse Pillars / Cables Distribution Cabinets

Location	Description Indoor/Outdoor		
Access	Front/Rear		
Material	Cast Iron, Steel, GRP		
Enclosure	IP		
Finish	Manufacturers standard or …		
Fuses/Switches/Ways	Incoming	Outgoing	
Terminations	Incoming	Outgoing	
Accessories			
Internal light	Yes/No		
Anti-condensation heater with thermostat	Yes/No		
Other			

Parameter	**Reference Y71.2112**	
Type :		**Interlocked Circuit Breakers**
Reference(s) :	**ATS – ASCO seies ATS/00/01 and ATS/03/01 Specific rating as per Drg No. DR-EL-401001**	**ATS – yy**
Standards :	BS EN 60947-1 BS EN 60947-6-1	
EMC	BS EN 55011 – Group 1, Class A BS EN 60947-1 BS EN 60947-6-1 BS EN 61000 series	BS EN 61439-1 Environment A Light Industrial/Commercial
Application :	Fire Fighting Services Secondary Supplies	Fire Fighting Services Secondary Supplies
Environment:		
Location	Indoor, <1,000m	
Ambient Temperature Range	-5°C to 40°C, without derating	
Humidity	Maximum 95% RH, non condensing	
Construction:		
Transfer switching device	Solenoid operated, withdrawable contactors	Motorised, plug-in MCCB's
Interlocks	Mechanical and electrical Electrical	Mechanical and electrical
Mounting arrangement	Enclosed, floor standing cubicle	Floor standing cubicle / Incorporated within lv switchboard
Adjustable Height Raised Floor Plinth (with floor tile supports)	N/A	N/A
Form (BS EN 60439-1)	Form 2	Form 4
Access	Front	Front
Degree of ingress protection (BS EN 60529)	IP31	IP3X
Colour	RAL 3020 Traffic Red	RAL 3020 Traffic Red
Special Markings / Labels	1. 'Broadband' schematic markings of primary and secondary source power supply routes, coloured to match source colour code. 2. Full user operating instructions.	
Maximum dimensions:		
Width		
Depth		
Height		
Cable entries:		
Input supplies	Top	Top
Output supply	Top	Top
Ventilation	Natural	
Provisions for thermal imaging	No special requirements	
Anti-condensation heater		

Input Specification:

Parameter	**Reference Y71.2112**	
Type :		**Interlocked Circuit Breakers**
Reference(s) :	**ATS – ASCO seies ATS/00/01 and ATS/03/01 Specific rating as per Drg No. DR-EL-401001**	**ATS – yy**
Electricity supply :		
Rated operational voltage (U_e)	400V -14%, +10%	
Nominal Frequency and tolerance	50Hz ± 1%	
Rated insulation voltage (U_i)		
Rated impulse withstand voltage (U_{imp})	6kV	
Incoming supply cable terminals (minimum size)	??mm^2	??mm^2
External circuit protective device	Source 1: ?A 4 Pole MCCB Source 2: ?A 4 Pole MCCB Refer to schematic for details	Source 1: ?A 4 Pole MCCB Source 2: ?A 4 Pole MCCB Refer to schematic for details
Input protective devices:	N/A	
Overcurrent / short circuit		Protective relay fitted to circuit breaker
Inphase monitor	Yes	
Output Specification:		
Protective devices		
Type		N/A
Rating		
Duty:		
No of Poles	4 Pole Refer to schematic for details	4 Pole Refer to schematic for details
Continuous (Uninterrupted) Ratings :		
Phase poles (I_{e_L})	Refer to schematic for details	Refer to schematic for details
Neutral pole (I_{e_N})	Refer to schematic for details	Refer to schematic for details
Load power factor range	0.8 lagging (inductive) to 0.8 leading (capacitive)	
Load handling range	0 to 100% rated load	
Utilization Category	AC-33A	AC-33A
Classification (BS EN 60947-6-1)	Class PC	Class CB
Short-circuit Characteristics:		
Rated short-time withstand current (I_{cw})	To be confirmed by manufacturer	
Rated short-circuit making capacity (I_{cm})	To be confirmed by manufacturer	
Rated short-circuit breaking capacity (I_{cn}) – (For Class CB)	To be confirmed by manufacturer	

Parameter Type :	**Reference Y71.2112**	**Interlocked Circuit Breakers**
Reference(s) :	**ATS – ASCO seies ATS/00/01 and ATS/03/01 Specific rating as per Drg No. DR-EL-401001**	**ATS – yy**
Prospective short circuit currents:		
$I_{p_{max}}$	kARefer to schematic for details	kA Refer to schematic for details
$I''_{k_{max}}$	kA Refer to schematic for details	kA Refer to schematic for details
Internal Bypass :	Independent 4 Pole manual bypass permitting bypass to either source, with mechanical and electrical interlock to prevent parallel connection of the input sources.	None
Load Isolation Function:	Yes	Yes (By opening both source circuit breakers)
External Bypass:	N/A	
Operation :		
Monitored supply deviations:		
Voltage supply deviation	3 Phase 230V +10%,-15% U_n, accuracy ± 1%	3 Phase 230V-15% to -60% U_n
Voltage unbalance between phases.		
Frequency supply deviation	50Hz ± 1%, accuracy 0.2%	
Source stabilization time	Adjustable 0 to 6s, initially set @ 6s	
Input voltage / frequency sensing	Source 1 and Source 2	Source 1 and Source 2
Transfer mode	Open transition	
	Open transition with overlapping neutral pole	Open transition
	Closed transition	
Operating times:		
Contact transfer times:	ms	N/A
Synchronous		
Asynchronous	ms	
Operating transfer times:		
Synchronous	ms	N/A
Asynchronous	ms	
Return transfer time	ms	
Off –time (delayed transition)	Adjustable 0 to 60s set @ ?s	Adjustable between 0.1 and 30s.
Total operating times:		
Synchronous	ms	N/A
Asynchronous	ms	2s
Retransfer time delay (automatic re-transfer only)	Adjustable 0 to 60 minutes	Adjustable between 10 and 180s.
Maximum contact overlap time	>100ms (applicable to closed transition types only)	N/A
Maximum crest factor of input voltage waveforms	3:1	

Parameter Type :	**Reference Y71.2112**	**Interlocked Circuit Breakers**
Reference(s) :	**ATS – ASCO seies ATS/00/01 and ATS/03/01 Specific rating as per Drg No. DR-EL-401001**	**ATS – yy**
Input voltage THD(V)	<15%	
Source Synchronisation:		
Transfer Phase Angle Window	5° (applicable to closed transition types only)	N/A
Synchronization time limit	Adjustable between 5s and 60s. Initially set at 30s.	N/A
Preferred Source	User selectable, either Source 1 or Source 2	User selectable, either Source 1 or Source 2
Automatic Mode Operating sequence:		
Failure of preferred source	Transfer to secondary source	Transfer to secondary source
Restoration of preferred source	Automatic retransfer to primary source or Remain on secondary source, which becomes preferred source.	Automatic retransfer to primary source or Remain on secondary source, which becomes preferred source.
Manual Mode Operating sequence:		
Transfer initiated (locally or remote):	In phase detection to initiate transfer and provide a synchronous transfer to the secondary source.	Transfer to secondary source
Indicators:		
Transfer switch state mechanical indicators.	Yes	Yes
Bypass switch position mechanical indicators	Yes	N/A
Controller:		
Type	Microprocessor	
Indications:	Primary and Secondary Source Healthy Load connected to primary / secondary source.	Primary and Secondary Source Healthy (via the phase failure relays) Load connected to primary / secondary source.
Mimic(s)	Isolation positions Bypass positions	
Functions:		
Display facilities:	Date and time User help instructions System status Source status Time delay status Alarms	

Parameter Type :	**Reference Y71.2112**	**Interlocked Circuit Breakers**
Reference(s) :	**ATS – ASCO seies ATS/00/01 and ATS/03/01 Specific rating as per Drg No. DR-EL-401001**	**ATS – yy**
Control facilities:	Menu navigation controls Manual / Automatic transfer mode selection Manual transfer to alternate source. Alarm reset Key operated test mode switch.	Key operated test mode switch. Key switch to enable Source 1 or Source 2 to be selected as the PRIMARY source.
Monitoring facilities:	Event log, with time and date stamp. Statistical analysis	
Programmable Adjustments (system settings):	Voltage and frequency drop out and pick-up values Time delay settings Feature settings	N/A
User Access Control:	Password protection to all system settings.	Key operated control switches
Measurements		
Event record log minimum record storage	99 events including time and date of each event	N/A
Statistical analysis	Total number of transfers Number of transfers caused by primary source failures Hours available for each source.	
Alarms	Failure to synchronize Extended parallel time Transfer locked out Failure of primary and secondary sources	Failure of primary and secondary sources
Controls Outputs:		
Volt free contacts for connection to BMS / Fire fighting status monitoring system (2No contacts per condition):	Source 1 failed Source 2 failed Source 1 on line Source 2 on line Transfer inhibited Not on preferred source Common alarm Bypass switch status Isolator switch status	Source 1 failed Source 2 failed Source 1 on line Source 2 on line Mode selector switch in ‘test’ position. Open, closed and withdrawn status for each circuit breaker.
Control signals (volt free contacts):	Generator run signal (with adjustable 0 to 6sec delay on initiation) Extended parallel time	
Communications Links		
Control Inputs:		
Control signals:	Remote transfer control Load shed signal	

Factory and Site Witness Tests

Type, Routine and Special Tests

The Transfer Switch Manufacturer shall perform the following witness tests, for each unit:

Test	Reference	Required		Comments / Notes
		Works	Site	
Type Tests				
Constructional Requirements				
Degree of protection of enclosure	BS EN 60947-1 8.2.3			
Performance Tests				
Operation	BS EN 60947-6-1 8.3.3.1			
Controls, sequence and limits of operations	BS EN 60947-6-1 8.3.3.2	✓		
Temperature Rise	BS EN 60947-6-1 8.3.3.3			
Dielectric properties	BS EN 60947-6-1 8.3.3.4	✓		
Short-circuit making capacity Short-circuit breaking capacity Short – time withstand current Conditional short-circuit current	BS EN 60947-6-1 8.3.3.5, 8.3.4.2.1, 8.3.4.3, 8.3.4.4			
Operational performance capability	BS EN 60947-6-1 8.3.3.6	✓		
EMC	BS EN 60947-6-1 8.5			
Routine Tests				
Functional Tests				
Checking of auxiliary devices	BS EN 60947-1 8.3.1	✓		
Verification of operating mechanism	BS EN 60947-6-1 8.3.3.1	✓		
Verification of controls, sequence and limits, e.g. switching of loads (transfer and re-transfer between each source). To include simulation of the following for each path (where applicable): Mains failures Input voltage deviations Phase failure	BS EN 60947-6-1 8.3.3.2.3, 8.3.3.2.4, 8.3.3.2.5	✓	✓	Works tests to be performed with 100% rated reactive load.
Transfer time test		✓		
Verification of dielectric withstand	BS EN 60947-6-1 8.3.3.4	✓	✓	Duration of application of test voltage may be reduced to 1s

Test	Reference	Required		Comments / Notes
		Works	Site	
Demonstration of each alarm condition		✓	✓	
Demonstration of each monitoring and control function.		✓	✓	

Notes:

1. All measurements to be carried-out using a 4 channel measuring computer (with waveform storage capability) to monitor the voltage and current waveforms of the input voltages (Source 1 and Source 2) and the voltage and current of the output and allow measurement of the interruption time in the output voltage waveform during transitions.

Luminaire Ref.	Description	Lamp type / colour
P (Apartment)	Pendant light fitting (flats) MK Electric K1186WHI or equal and approved (14W)	Replaceable bulb/2700K
D1 (Apartment)	LED recessed downlight RIDI Lighting “EBDST” or equal and approved(11.4W)	LED IP65 replaceable bulb/2700K
D2 (Apartment)	LED recessed downlight RIDI Lighting “EBDST” or equal and approved(11.4W)	LED IP44 replaceable bulb/2700K
W1/E	Circular Ceiling mounted LED IP44 for circulation areas (stair cores,) with emergency pack RIDI Lighting “BORA” or equal and approved(14W)	LED/3500K
W2	External wall mounted light for entrances (main entrances) PEDESA, RIDI Lighting(14W)	LED/4000K
W2/E	Circular Ceiling mounted LED IP65 for circulation areas (external decks)with emergency pack RIDI Lighting “BORA” or equal and approved(14W)	LED/4000K
W3	Wall mounted bayonet light fitting for flats’ utility cupboards and store MK Electric K1172WHI or equal and approved(14W)	Replaceable bulb/2700K
W4/E	External wall-mounted light with Photocell and PIR AVAWP2 L30** OP Dextra AVALON WALLPACK LED or equal and approved(22.6W)	LED/4000K
A1	Linear LED IP44 for Plantrooms WHITECROFT ACH34K ACL INDUSTRY 28 W or equal and approved	LED/4000K
A1/E	Linear LED IP44 for Plantrooms, with integral emergency module WHITECROFT ACH34K ACL INDUSTRY 28 W or equal and approved	LED/4000K
A2	Linear LED IP44 for cycles stores, Bin Store WHITECROFT ACH44K ACL INDUSTRY 33 W or equal and approved	LED/4000K
A2/E	Linear LED IP44 for cycles stores and Bin Store, with integral emergency module WHITECROFT ACH44K ACL INDUSTRY 33 W or equal and approved	LED/4000K
B1	Circular Ceiling mounted LED IP44 for circulation areas (corridors, lobbies, etc) WHITECROFT K4H4154KS KOLO SURFACE 15W 1657lm or equal and approved	LED/3500K

B1/E	Circular Ceiling mounted LED IP44 for circulation areas (corridors, lobbies, etc), with emergency pack WHITECROFT K4H4154KS KOLO SURFACE 15W 1657lm or equal and approved	LED/3500K

NOTES:
3. This schedule shall be read in conjunction with the specification for full details of items. 4. Manufacturers references are for guidance only and the Trade Contractor shall verify these in conjunction with the description and ensure all necessary components are included to afford a complete installation ie. suspension kits etc. 5. All cut out sizes are to be confirmed by the Contractor. 6. All fluorescent lamps shall be tri-phosphur, unless indicated otherwise. 7. The Trade Contractor shall ensure recessed luminaires are compatible with ceiling types.

EMERGENCY LIGHTING CLASSIFICATIONS			
Type:	Mode of operation:	Facilities:	Duration of emergency mode (in minutes) for a self-contained system:
X - self-contained; Z - central supply	0 - non-maintained; 1 - maintained; 2 - combined non-maintained; 3 - combined maintained; 4 - compound non-maintained; 5 - compound maintained; 6 - satellite;	A - including test device; B - including remote rest mode; C - including inhibiting mode; D - high risk task area luminaire;	10 to indicate 10 min duration; 60 to indicate 1 h duration; 120 to indicate 2 h duration; 180 to indicate 3 h duration

Accessory Type / Function	Location(s) / Application(s)	Mounting	IP Rating	Apparatus Grouping	Enclosure Material	Device Mounting	Plate				Switch / Operator			Insert Colour	Indicators	Dual earth terminals	Notes
							Finish / Material	Hidden Fixings	Flex Outlet	Neon Halo	Location / Type	Finish / Material	Integral Neon				
Light Switches	Generally (Except areas noted below)	Recessed	IP2XD			Grid	Brushed stainless steel	Y			Rocker	Black plastic		Black			
	Glass Wall Partitioned Offices	Recessed / Architrave	IP2XD			Grid	Brushed stainless steel				Rocker	Black plastic		Black			
	Residential areas	Recessed	IP2XD			Plate	Graphite / plastic				Wide Rocker	White					
	Plantrooms & Risers	Surface	IP4X		Aluminium	Grid	Aluminium				Rocker	White plastic		White	G		Neon indicator to be permanently illuminated to aid location.
	External	Surface	IP56		Polycarbonate	Plate	Polycarbonate				Wide Rocker	Polycarbonate					
	Gas Meter, Oil Storage or Foul Sump Rooms	Surface	IP65	IIC	Hit dipped galvanised Cast Iron		Manufacturers Standard				Rotary Cam	Manufacturers Standard					
Lighting Scene Controllers	Meeting Rooms	Recessed	IP2XD			Plate	Brushed stainless steel				Momentary Push button	Black plastic	Y		R		Switch neon to illuminate to indicate scene selected. Switch plates to be screen printed above each gang …..
13A Switched Socket Outlets	Generally (Except areas noted below)	Recessed	IP2XD			Plate	Brushed stainless steel	Y			Rocker	Black plastic	Y				
	Office Areas	Flush Dado Trunking mounted	IP2XD			Plate	White plastic				Outboard rockers	Red	Y			Y	
	Plant Areas	Surface	IP4X		Aluminium	Plate	Aluminium				Rocker	White plastic	Y				

Accessory Type / Function	Location(s) / Application(s)	Mounting	IP Rating	Apparatus Grouping	Enclosure Material	Device Mounting	Plate				Switch / Operator			Insert Colour	Indicators	Dual earth terminals	Notes
							Finish / Material	Hidden Fixings	Flex Outlet	Neon Halo	Location / Type	Finish / Material	Integral Neon				
	Residential Areas	Recessed	IP2XD			Plate	Graphite / plastic				Outboard rockers	White	Y				
Double, switched with two USB charging socket outlets	Generally and office areas as indicated on drawings	Recessed	IP2XD			Plate	White plastic or brushed stainless steel as noted										
Industrial Socket Outlets	Equipment Rack Supplies	Trunking	IP44								N/A			N/A			
	External	Surface	IP67		Polycarbonate												
Switched Fused Connection Units	Kitchen Appliances	Flush	IP2X			Plate	Satin Stainless Steel				Rocker	Satin Stainless Steel			Y		Plate to be engraved with the designation of the appliance served.
	Hand driers	Flush	IP2X		Polycarbonate	Plate	White plastic										

NOTES:

1. Accessory plates shall be engraved in accordance with Specification Clause Y82.2121
2. All flush accessories are to be provided with overlapping cover plates.

KEY:

Apparatus Grouping for Explosive Atmospheres to BS EN 60079:

- IIA Group IIA
- IIB Group IIB
- IIC Group IIC

Indicator Colours:

- A Amber
- B Blue
- G Green
- R Red

Y74sch2 – Schedule of Electrical Equipment / Accessory Mounting Heights

Clause References

Y74.3030 - Fixing
Y74.3041 – Measuring mounting heights
Y74.3051 - Standards

MOUNTING HEIGHTS:

Mount electrical accessories in accordance with the following table, unless otherwise indicated. Measurement to be to top (T) or bottom (B) of equipment / accessory from either finished floor or worktop. If specified height coincides with top of tiling mount above tiling with a clear gap of 50mm. Where located below a worktop mount 100mm below underside of worktop.

Electrical Equipment / Accessory	Location	Standard Mounting Height (mm)	Project Specific Mounting Height (mm)
Lighting switch		1,200 (T)	
Socket outlet	General	450 (B)	
	Kitchen not above work surface	1,000 (T)	
	Above work surface	150 above surface to bottom of accessory	
	Plantroom	1,000 (B)	
	External	1,000 (B)	
Shaver socket outlet		1,000(B)	
Fused connection unit	General	450(B)	
	Above work surface	150 above surface to bottom of accessory	
Fused connection unit controlling	Radiant heater:– wall	1,800(T)	
	Radiant heater:– focal point	450(B)	
	Tubular heater	450(B)	
	Clock	1,900(T)	
Cooker control unit	Above worktop	150 above surface to centre of accessory	
Cooker connection unit		600(B)	
Room temperature thermostat or sensor with no set point control.		1,400(T)	
Room temperature thermostat or sensor with set point control.		1,000(T)	
Telephone outlet		between 450(B) to 1200 (T)	
Radio/TV outlet		450 (B)	
Pushbutton		1,200 (T)	
Control panels	Domestic premises	1,200 to top	
	Non-Domestic Premises	1,800 to top	
Fire alarm manual call point		1,200(T)	
Fire Detector local indicator	Ceiling mounted detector	2,200 or 200mm below ceiling if less than 2,400mm	
Evacuation Alert System Control & Indicating Equipment (EACIE) cabinet		1,400(B) 2,200(Top most manual control)	
Evacuation Alert Device	Ceiling or wall	150 maximum below ceiling level	
Gaseous Extinguishing System Status Indicators		1,200	

Y74sch2 – Schedule of Electrical Equipment / Accessory Mounting Heights

Electrical Equipment / Accessory	Location	Standard Mounting Height (mm)	Project Specific Mounting Height (mm)
Bell or buzzer		1,900	
Fire Alarm Visual Indicator		2,000 or 200mm below ceiling if less than 2,400mm	
Wall mounted loudspeaker		2,200 or 200mm below ceiling if less than 2,400mm	
Emergency Voice Communication Handset		950	
Distribution Boards	Non-domestic premises	1,800mm to the top	
	Domestic premises	1,200mm to the top	
Local Isolators / Inverters / Starters		Between 750 and 1,200	

Notes :

1. 'Standard' mounting heights are based upon compliance with BS 8300 Parts 1 or 2 and Approved Document M (vols 1 or 2) of the Building Regulations for Dwellings to suit building type, all mounting heights shall be confirmed with the Architects.
   The heights are for rooms and circulation areas in dwellings, and office, reception and general circulation areas of other premises, use the following preferred standard mounting heights for wall-mounted accessories:
2. Outlets and switches shall be located a minimum of 350mm from room corners
3. In car parks and garages comply with appropriate Petroleum Regulations for mounting heights of electrical outlets, normally a minimum of 1,200mm.
4. For wheelchair access the following pull cord lengths are recommended:–
   Ceiling mounted switches
   Cord pulls to extend to 1000mm above finished floor level.
   Alarm pulls to be coloured red and have two red 50mm diameter bangles, one set at 100mm and the other set between 800 and 1,000mm above the floor.
   Shower circuit switch
   Pull cord to isolating switch to extend to 1000mm above finished floor level.

Test Description	Required Yes/No	Notes
Continuity of protective conductors	Yes	
Continuity of ring final circuit conductors	Yes	
Insulation resistance	Yes	
Site applied insulation		
Separation of circuits		
Direct contact protection		
Insulation of building elements		
Polarity	Yes	
Earth electrode resistance		
Earth fault loop impedance (Protection by automatic disconnection of supply)	Yes	
Functional protection		
Measurement of voltage drops		
Generator		
Transformer Specify		
Switchgear detail required		
Protection System		
Cables		

Contractor/testing authority to provide verification of calibration of any test equipment/instruments used.

End of Specification

This is the final page of the specification.